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12 October 1979

USSR REPORT

BIOMEDICAL AND BEHAVIORAL SCIENCES

No. 122

This serial publication contains articles, abstracts of articles and news items from USSR scientific and technical journals on the specific subjects reflected in the table of contents.

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PROBLEMS OF PHARMACOLOGY IN SPACE MEDICINE

Moscow FARMAKOLOGIYA I TOKSIKOLOGIYA in Russian No 4, 1979 pp 325-339

[Article by V. S. Shashkov and B. B. Yegorov, submitted 1 Dec 78]

[Text] Specialists in space biology and medicine have made a large contribution to the solution of complex engineering and technical problems of assuring the safety of space flights. Space medicine emerged because of the needs of cosmonautics, and it organically accumulated the achievements of physiology, biochemistry, hygiene, symptomatology and other biomedical sciences (A. I. Burnazyan et al., 1977).

Analysis of the results of medical monitoring and examinations during flights, which was performed by a team of highly qualified specialists (A. I. Burnazyan et al., 1977), revealed that space flight conditions induce deviations of a number of physiological parameters of the human body: change in functional state of the cardiovascular system, fluid-electrolyte balance, a set of symptoms similar to motion sickness, demineralization of bone tissue, impairment of biochemical indices, loss of muscle and body weight, anemic syndrome, decreased immunobiological reactivity and others. Development of pharmacological agents for prevention and treatment of disturbances induced by exposure of the body to space flight factors is being pursued in accordance with the above-mentioned sets of symptoms.

This problem of using drugs in space medicine has been discussed extensively in the Soviet and foreign literature (P. P. Saksonov et al., 1965, 1968; V. Ye. Belay et al., 1967a, b; V. S. Shashkov et al., 1967; P. V. Vasil'yev et al., 1971; V. V. Parin et al., 1969a; Berry, 1961, 1965; Schmidt, 1965; Graybiel, 1975, and others). It cannot be considered solved as yet, since experimental substantiation and choice of drugs for onboard medicine kits are determined by the nature and duration of a flight, presence of a physician among the crew members, etc. With expansion of programs and conditions of flights, as well as experimental and clinical studies of space pharmacology on the ground (model experiments), there will be a constant increase in the armamentarium of drugs contained in onboard medical packs and kits.

In view of the specifics of activities of the crews of flying vehicles and conditions, under which cosmonauts may take drugs, some authors have raised

the question of the need to create a new branch of pharmacology, space or, more precisely, space and aviation pharmacology (P. P. Saksonov et al., 1968; V. V. Parin et al., 1969b; V. S. Shashkov et al., 1967). This is all the more important since the influence of flight factors resembles, in many respects, extreme factors on the ground, and this is attributable to the substantial change in quality of labor (operator activity, radiation safety service, servicing of special installations, etc.).

Weightlessness is the main factor that alters vital functions during space flights. Comprehensive investigation of the physiological effects of this factor is the main problem of space medicine and biology (N. N. Gurovskiy and A. D. Yegorov, 1976). The effects of weightlessness, which man has encountered for the first time, are diverse, while the pathogenetic mechanisms of some of them, which have been summed up by I. D. Pestov and Z. D. Geratevol' (1975) and Ye. A. Kovalenko (1977), require definition.

1. Modeling the Effects of Weightlessness

Some extremely valuable information about the effect on the human body of weightlessness and other space flight factors was obtained in the course of space flights and as a result of postflight examination of cosmonauts. However, the existing data are sparse as yet. For this reason, extensive research is being pursued on simulation of space flight factors on the ground.

In 1977, Ye. A. Kovalenko classified and offered a critical analysis of the methods of modeling and simulating the effect of weightlessness on the body under ground-based conditions. For this purpose, wide use is made of immersion in liquid media, including "dry" immersion, hypokinesia in the form of prolonged bed rest (clinostatic, antiorthostatic [head down]); stands are used to simulate weightlessness, as well as variable gravity (brief and long-term rotation in special systems), immobilization and denervation. One of the methods of simulation is the use of pharmacological agents to exclude muscular function (myorelaxants), when it is possible to obtain the effect of functional impairment of skeletal muscles and metabolic processes in muscles (V. V. Parin and B. M. Fedorov, 1969).

Of course, modeling reproduces only partially several or individual elements of changes inherent in the set of space flight factors. Nevertheless, modeling can offer a substantial contribution to identification of the pathogenetic mechanisms of action of weightlessness on the body and development of a system of preventive and therapeutic measures to be used aboard a spacecraft.

2. Space Pharmacology (Achievements, Directions, Prospects)

At the present time, we are entitled to maintain that the use of pharmacological agents to back up manned space flights is acquiring special significance in view of the increase in duration of orbital flights and planned colonization of space by man in the foreseeable future.

In past missions, the medical packs aboard Soviet and American spacecraft contained a relatively small assortment of drugs referable to the groups of cardiovascular agents, analeptics, analgesics, psychotropic agents, antibiotics, agents for the prevention and treatment of "seasickness," vitamins, etc. The first experience with the use of drugs in the group of stimulants of work capacity was obtained during the missions aboard Apollo-7 and Apollo-8 spacecraft.

There were only 12 products aboard the American space craft Gemini-7. Subsequently, the onboard medicine kits contained more than 20 different drugs (Berry, 1969a, c), and in subsequent flights aboard orbital space complexes the kits contained more than 50 drugs referable to different groups. The onboard medicine chest aboard the Skylab orbital stations already contained 62 products (Johnston, 1974).

By far not all drugs that are traditionally used for different types of pathology and functional disturbances can elicit the desired preventive or therapeutic response under such unique conditions as space flights, since the pharmacodynamics of drugs, reactivity of the body in weightlessness and pathophysiological mechanisms of effects of the latter have not yet been completely identified. Under the new conditions of interaction between the body and a drug, there may be some still unknown elements of pathogenesis of disturbances and qualitatively new aspects of drug action. It is quite understandable that new products must be developed for intake under the specific conditions of man's vital functions, which would be capable of normalizing the physiological functions impaired by the habitat. Such disturbances cannot be qualified as development of a pathological process, but they could hinder or make difficult the performance of planned programs and even present a danger to health and safety during and after a flight.

The back-up for space flights in space and aviation medicine provides for a number of stages: period of preparations, take-off and insertion into orbit, free space flight, prelanding and landing period, period of taking care of the crew after returning to earth (V. V. Parin et al., 1969a, b). The objectives of experimental and clinical pharmacology have specific elements at each of these stages.

Preflight period: During this period, depending on the duration, objectives and nature of the flight, determination is made of the assortment and amount of drugs needed to support the mission, on the basis of the existing experience of experimental and clinical studies. Tests are made of individual tolerance of a number of drugs, with intake of which side-effects are possible (allergy, reverse effect, etc.). The cosmonauts learn about the rules for taking drugs, indications and contraindications. Special attention is given to the possibility of allergic reactions to drugs, determination of tolerated doses for single and repeated intake. In the case of negative results of trials, a drug or combination thereof is replaced by those that are well tolerated. During the preparatory period, the efficacy of drugs is tested, if necessary or specially, in

in experiments on animals and under clinical conditions when simulating space flight factors.

During this period, it is of special importance to keep track of reactions to a drug in weightlessness and after the flight, when the body is again exposed to gravity. There has been previous discussion of the changes in reactions of mammals to drugs in the presence of an altered gas environment, exposure to accelerations and radiation (V. S. Shashkov et al., 1967; V. V. Parin et al., 1969a, b; P. P. Saksonov et al., 1968, 1976; P. V. Vasil'yev et al., 1971).

It is particularly important to study the body's reaction to drugs when simulating weightlessness, and this determines the choice of doses and programs for intake of a drug during an actual flight. In view of methodological difficulties, this matter has been little-studied as yet. There are only a few experimental data on sensitivity of the organism to drugs in the presence of hypokinesia as an approximate model of weightlessness.

L. A. Kravchuk and V. G. Ovechkin (1968) demonstrated substantial changes in the reaction to narcotics in experiments on mice whose movements were very restricted. After 37 days of hypokinesia in special cages, there were changes in all stages of barbamyI anesthesia: rapid onset of excitation and later sleep, with decrease in duration of sleep. P. V. Vasil'yev et al. (1971) observed deeper and longer intranarcon-induced sleep in experiments on rats, with 14- and 28-day hypokinesia. The physiological effects of epinephrine, norepinephrine, serotonin, histamine and acetylcholine were studied on dogs under chloralose anesthesia during 12-24-h immersion (Walawsky and Kaleta, 1965). These authors failed to demonstrate changes in cardiovascular reactions to the tested products, and this is most likely attributable to the brief period of simulation of weightlessness. In our laboratory (L. Ya. Kolemeyeva and V. S. Shashkov, 1974; L. Ya. Kolemeyeva et al., 1975, 1977), an extensive study was made of changes in animal sensitivity to drugs referable to the anesthetic, stimulant and radio-protective groups during long-term restriction of movement. It was established that the sensitivity of animals (albino rats) to chloralhydrate, hexenal and urethane at different stages of hypokinesia (5th-60th days) depends on duration of immobility and nature of the narcotic agent.

The data obtained in experiments by no means offer a complete solution for practical problems of selection and scheduling intake of drugs during space flights and in the presence of other experimental factors. They are indicative of a need to expand research in this direction under experimental and clinical conditions.

In this regard, the work of P. V. Vasil'yev and B. Yu. Lapinskaya (1969) is of great interest; it deals with investigation of the distinctive features in the effects of a set of stimulants (caffeine, strychnine, phenamine) on subjects who spent a long time in clinostatic hypokinesia. The authors established that there is attenuation of the reaction of the cardiovascular

system to these agents during hypodynamia, particularly at the late stages (30th-37th days), or else a distorted effect is observed. Total restoration of the reaction of the cardiovascular system to the stimulants was not demonstrable, even 2 weeks after discontinuing hypokinesia.

We should dwell specially on prevention of infections in the preflight period. V. V. Parin et al. (1969a, b) believe that the main task is to free the body as completely as possible from potentially pathogenic microflora: removal thereof from the skin, oral, nasal and respiratory tract mucosa, with concurrent cleansing of the gastrointestinal tract. Development of resistant forms of microorganisms, superinfection and side-effects of preventive and therapeutic agents (chemotherapeutic agents, antibiotics) presents a great hazard in the course of a long-term flight, in view of decrease in systemic reactivity. V. V. Parin et al. recommended development of special drug forms of antiseptics, disinfectants and other products that would be suitable for use in weightlessness, with due consideration of individual distinctions of the cosmonauts' microflora.

Accelerations: The question of pharmacological back-up of lift-off and landing of manned spacecraft, taking into consideration the effects of accelerations, vibration, etc., has been comprehensively discussed in the works of V. V. Parin et al. (1969a, b), P. V. Vasil'yev et al. (1971).

Of course, development of special drugs for the effects of accelerations should be pursued concurrently with refinement of technical means of protection against them.

Space flights: Biomedical research conducted on the ground and during the flights aboard the Soviet Salyut and American Skylab orbital stations yielded rather extensive information about the reactions of man to long-term weightlessness. Although the experiments failed to demonstrate substantial changes in the body that would restrict extension of space flights, space medicine does not yet have sufficient data about the time of adaptation to space flight conditions. Considerable material has been accumulated to date concerning the reactions of different physiological systems and the body as a whole at different stages of a flight and in the post-flight period.

"Motion sickness": The set of symptoms that outwardly resembles seasickness has been given the general name of "motion sickness (kinetosis, seasickness)". It is usually present for about the first 7 days of a space flight, and it is more or less severe in different cosmonauts (astronauts). "Motion sickness" may affect the work capacity of the crew during the first, important stage of an orbital flight. The problem of preventing "motion sickness" is gaining much importance in connection with the increased role of man in controlling the flight and landing of nonexpendable spacecraft. Thus, virtually all 33 American astronauts who were among the crew members of the Apollo spacecraft presented symptoms of illusions and "motion sickness." In the first two flights aboard the Skylab orbital

station, the performance of astronauts was made difficult by "motion sickness," which lasted for 3-5 days. An attack of this sickness also occurred during the third expedition aboard Skylab. Analogous changes in vestibular reactions were observed during the flights made by Soviet cosmonauts (I. D. Pestov and Z. D. Geratevol', 1975).

The outstanding American specialist, Graybiel (1972) believes that one should expect the most of drugs in the search for ways and means of preventing "motion sickness." The importance of finding means of preventing and treating this condition is unquestionable. Moreover, the development of marine navigation, aviation and exploration of space has made control of "motion sickness" one of the pressing tasks for preventive medicine. Scientists are faced with an extremely complex task: to find an agent that would not only prevent the sickness, but would have no side-effects that would impair work capacity.

To date, an enormous number of products and different combinations thereof have been tested as means of preventing and treating "motion sickness" (N. Ya. Lukomskaya and M. I. Nikol'skaya, 1971; P. V. Vasil'yev et al., 1971; Brand and Perry, 1966; Wood and Graybiel, 1968; Brandt et al., 1974, and others). It is difficult to name a group of drugs that has not been tested as a means of preventing this morbid state.

Success on the route of the rational search for agents against seasickness is largely determined by the proper choice of experimental methods. There are two main approaches to this problem: reproduction of the different, most typical symptoms of "motion sickness" and reproduction of the entire syndrome of seasickness. In addition, the former route is very important to determination of both the mechanisms of onset of the sickness and mechanisms of protective action of the products.

At the present time, it is generally recognized that the method of quantitative evaluation of efficacy of drugs, conducted in a slowly revolving system (Kennedy and Graybiel, 1962), with the use of the "double blind" method, is the most informative in application to man. It should be mentioned that there are specific requirements made of agents that are designed to prevent and treat vestibular disturbances in spacecraft and other moving systems involving extremely accurate control, and they minimize the possibility of a wide choice of such agents. At the same time, it is apparent that development of such agents is proceeding in the direction of combining drugs referable to different chemical classes. This is all the more probable since a set of physiological and biochemical factors plays the leading role in the pathogenesis of "motion sickness," and the substance of these factors is not yet clear (G. N. Kassil' and B. I. Polyakov, 1977). It would be desirable to devote special studies to analysis of these questions and the problem of finding means of preventing and treating "motion sickness."

Functional changes in the cardiovascular system during space flights: The first American physician-astronaut Kerwin (1974) wrote: "When man becomes weightless, he is very aware of the fact that profound changes begin to occur immediately in his body. A strange sensation appears of congestion of the head and nose, and speech acquires a nasal quality. The faces of one's comrades appear puffy." Deconditioning of the cardiovascular system develops during a space flight and prolonged restriction of movements (hypokinesia) (L. I. Kakurin et al., 1976). Hyperemia of the face, edema of the nasopharynx and facial tissues in weightlessness can be directly related to redistribution of blood (Ye. I. Vorob'yev et al., 1970). A large group of American specialists headed by D. Lindsley (1974) believes that, in the course of long-term bed rest and space flights, a role is played in onset of the above disturbances not only by the lowhydrostatic pressure, but muscular atrophy, decreased efficiency of the muscular pump and reduced volume of circulating blood recorded by baroreceptors.

The phenomenology, nature and severity of hemodynamic changes and regulation during long-term restriction of movement and in weightlessness determine the place of pharmacology and its role in the prevention and treatment of cardiovascular disturbances. These tasks can be formulated as a search for substances that would aid in normalizing redistribution of blood, elimination of static phenomena in the pulmonary circulation and in the circulatory system of the brain, prevention of functional disturbances of the heart, enhancement of orthostatic stability, etc. Special attention should be devoted to the study of the use of drugs in conjunction with other therapeutic and preventive measures (physical exercise and conditioning, pressure ["load"?] suits, lower body negative pressure, etc.), which are directed toward maintaining conditioning of the vital systems. And special attention should be given to evaluation of agents for the prevention and treatment of arrhythmia, cardiotonic agents, products that influence the energy resources of the myocardium, in simulating space flight factors and in flight (ephedrine, papazol, isoptin, ritmodan, novocainamide, cytochrome c, aldactone K, glio-6, meksitil, aldactone, nitrol), and cerebrovascular disturbances (excuzan, glyvenol, stugeron). For example, it was shown that isoptin enhances physical work capacity in antiorthostatic hypokinesia, it improves the parameters of the cardiovascular system and increases orthostatic stability (O. D. Anashkin et al., 1977). This made it possible to include this product in the onboard medicine kits of spacecraft.

In view of the role of adrenergic regulation of circulation in general and cerebral circulation in particular (R. S. Mirzoyan, 1977), of great interest to space pharmacology are drugs referable to the groups of α - and β -adrenoblocking agents (tropaphen, phenoxybenzamine, anaprilin), sympatholytic agents (octadin, ornid) and rational combinations thereof. Products with a β -adrenoblocking effect are considered to be agents for the prevention of myocardial infarction or cardiac arrhythmia in the presence of prolonged emotional stress (Eliot and Forker, 1976) and orthostatic instability related to hemodynamic changes in weightlessness.

Questions of therapeutic care during the readaptation period after spacecraft crews return to earth require special investigation.

The skeletomuscular system: As we know, weightlessness alters the conditions of muscular activity: there is no need of tonic tension of skeletal muscles to maintain a position, overcome body weight when moving about, etc. The stereotype that developed in the course of evolution for orientation of the body in the gravity field is completely lost in weightlessness. For this reason, under these conditions and with different forms of prolonged restriction of movement there is development of muscular atrophy and decrease in size of voluntary muscles. Gradual atrophy of skeletal muscles is one of the most consistent manifestations of the effect of weightlessness (I. I. Bryanov et al., 1976; Johnson, 1973).

Among the different pathophysiological effects of weightlessness and prolonged restriction of motor activity, what merits serious attention is the fact that the decrease in gravity and mechanical effects on the skeletomuscular system could lead to progressive demineralization and loss of strength of skeletal bones. It was shown that there is decalcification of bones during space flights and prolonged hypokinesia, and this is a typical manifestation of atrophy of skeletal tissue (Ye. N. Biryukov and I. G. Krasnykh, 1970; Berry et al., 1966; Kervin, 1969; Hattner and McMillan, 1968; Lynch et al., 1967).

In a survey of the effects of weightlessness on the human skeleton, Hattner and McMillan (1968) estimated that there would be a continuous loss of calcium during a space flight at the rate of 1-2% per month for 1 to several years. The opinion is held that calcium loss could affect mechanical strength of the skeleton (S. A. Gozulov and N. I. Frolov, 1969; Busby, 1967a) and could lead to a number of functional disorders: automatism of the heart, conduction of excitation, blood clotting, etc., due to increased passage of calcium into blood (Busby, 1967c; L. I. Kakurin and Ye. N. Biryukov, 1966).

There are basically three ways of affecting processes of decalcification of skeletal bones during long-term restriction of movements: balanced diet, physical exercise and administration of drugs.

At the present time, it has been shown that there is discoordination of metabolism of calcium in labile and stable components during long-term hypodynamia. There is a decrease in the rapidly metabolized supply of mineral salts in bone tissue; relative and absolute prevalence of the slowly metabolized supply is observed. Onset of osteopathies during prolonged hypokinesia, with retention of supporting function of the skeleton, is attributable to inhibition of osteogenesis, which leads to bone atrophy as a result of activation of resorptive processes, with concurrent depression of bone tissue synthesis (A. I. Volozhin, 1977).

As we know, calcium metabolism in the body is controlled by parathyroid hormone and thyrocalcitonin. Proceeding from the mechanisms of action of

these hormones, efforts were made to offer experimental substantiation for their use as agents to prevent disturbances of calcium metabolism during hypokinesia. Experiments on rabbits, guinea pigs, rats and chicks revealed that parotin does not lower the blood calcium level (Wynston et al., 1967). It was demonstrated that administration of thyrocalcitonin in a dosage of 0.315 mg per animal decreases decalcification of an immobilized rat limb (Wynston and Perkins, 1968). A. I. Volozhin (1977) obtained a marked hypocalcemic effect from giving the hormone to hypokinetic rats, in a dosage of 5 MRC (Medical Research Council) units. V. S. Shaskov et al. (1974b) demonstrated, in experiments on rabbits whose movements were restricted (for up to 30 days), that thyrocalcitonin attenuates significantly the severity of changes in bone tissue caused by hypokinesia, and it has a beneficial effect on the main parameters of mineral and protein metabolism in bone tissue. We should mention the development of new calcium products (glutamate, polypeptides), which are better assimilated by the body than inorganic salts, as one of the means of preventing and treating disturbances of calcium metabolism.

The above data show convincingly the need and prospects of searching for pharmacological agents to normalize calcium metabolism in the organism. Apparently, the route of a combination of rational systems of isometric exercises, physical training and drugs affecting pathogenetic mechanisms of disturbances of the skeletomuscular system in weightlessness will be found the most effective.

Changes in metabolic and endocrine processes: As a result of biochemical studies conducted on cosmonauts after flights, changes were demonstrated in metabolic processes and hormone content (metabolism of proteins, carbohydrates, acid-base equilibrium, enzyme activity, catecholamine content, etc.). The most significant changes found during space flights were in the system of regulation of fluid-electrolyte metabolism (A. I. Grigor'yev et al., 1976; I. D. Pestov and Z. D. Geratevol', 1975; I. S. Balakhovskiy and Yu. V. Natochin, 1973). The severity and direction of biochemical changes varied in cosmonauts from different spacecraft crews. Nevertheless, findings in common consisted of increase in concentration of hormones and catecholamines in blood, along with significant increase in excretion thereof in urine, which is indicative of marked intensity of adrenocortical function. There was activation of glucocorticoid function of the adrenal cortex during the actual flight, as confirmed by appreciable increase in excretion of 11-hydroxycorticosteroids and total 17-hydroxycorticosteroids in urine. Analogous findings were made in model experiments involving long-term antiorthostatic hypokinesia (R. A. Tigranyan et al., 1977; N. F. Kalita, 1977). Administration of a set of pharmacological products (strychnine, ephedrine and phenibut) during hypokinesia attenuated the severity of these hormonal changes (N. F. Kalita, 1977).

After flights varying in duration, cosmonauts presented marked dehydration and loss of salts as a result of increased diuresis and elimination of sodium during the flights. Fluid loss is one of the causes of weight loss, which is demonstrable in the postflight period and after terminating

experiments simulating weightlessness (L. I. Kakurin et al., 1973; I. D. Pestov and Z. D. Geratevol', 1975; A. I. Grigor'yev et al., 1976). At the same time, there is loss of electrolytes, in particular, sodium, potassium and chloride (Ye. I. Vorob'yev et al., 1969, 1970; Giovanni and Birkhead, 1964). In the opinion of most specialists (A. I. Grigor'yev and G. I. Kozyrevskaya, 1970; A. I. Grigor'yev, 1972; Berry, 1971; Natochin et al., 1973, and others), increased diuresis as a result of depressed secretion of ADH and aldosterone production, which leads to permeability of distal segments of the nephron to fluid and increased fluid excretion, is one of the main causes of fluid loss during flights. This opinion has been confirmed in ground-based model experiments (G. I. Kozyrevskaya et al., 1974; Epstein and Saruta, 1971; Gauer, 1973, and others).

Use of vasopressin or pitressin has been tried to normalize some parameters of fluid-electrolyte metabolism during hypodynamia (Gauer et al., 1965); as we know, this product activates hyaluronidase and increases permeability of the walls of renal tubules to fluid, aiding in retrograde absorption thereof in the peripheral segments of the nephron (A. G. Ginetsinskiy, 1964). Normalization of diuresis and elimination of Na^+ and K^+ during a prolonged stay by man in an immersion medium is observed after single administration or slow intravenous infusion of vasopressin (2 IU [international units]/min, 20 IU). It must be borne in mind that vasopressin reduces diuresis only in the presence of renal hyperfunction (Hunt, 1967). Administration of 9- α -orthohydrocortisone was tried to restore parameters of fluid-electrolyte metabolism, prevent loss of plasma, weight loss and elimination of other disturbances caused by bed rest. This product had a preventive effect on the above parameters at both the early (6th day) and late (up to 73th day) stage of hypokinesia (Stevens and Lynch, 1965; Stevens et al., 1966; Bohnn et al., 1969).

In our experiments (V. S. Shashkov et al., 1974a, b; 1977) on rabbits and rats, we tested the effect of thyrocalcitonin and 9- α -fluorohydrocortisone on metabolism of fluid, potassium, sodium and magnesium. These studies revealed that thyrocalcitonin lowers negligible elimination of magnesium and increases excretion of sodium and potassium in intact animals. In the case of hypokinesia, thyrocalcitonin did not have an appreciable effect on elimination of magnesium, potassium and sodium, but prevented dehydration of the body to a significant extent. In intact rats and during long-term hypokinesia, 9- α -fluorohydrocortisone had a diuretic and saluretic effect.

There are reports of the beneficial effect on fluid-electrolyte metabolism of pituitrin R, deoxycorticosterone acetate and nerobol (L. I. Kakurin et al., 1973). Evaluation of the effects of adiurecrine, retabolil, panangin and amitetravit on fluid-electrolyte metabolism, osmoregulatory and ionoregulatory functions of the human kidneys during long-term hypokinesia (Shashkov et al., 1977) showed that the combination of adiurecrine and retabolil was the most effective (first 3 days of hypokinesia).

Work capacity stimulants: Studies dealing with the question of work capacity have been analyzed by V. V. Parin et al. (1969a, b), P. V. Vasil'yev

et al. (1971), V. S. Shashkov et al. (1972-1977), P. V. Vasil'yev and G. D. Glod (1977). In the last few years, study thereof has become one of the main tasks for space biology and medicine.

With reference to methods of increasing work capacity, one must bear in mind the basic difference of this task as it relates to space, sports and occupational medicine. In view of the distinctions of cosmonaut work capacity, in such cases it is possible to make broader use of pharmacological agents and expressly stimulants (V. Ye. Belay et al., 1967a, b; V. V. Parin et al., 1969a, b).

Products such as phenamine, centedrin (ritalin, meridil, reactivan, mefexamide, duclidin, actebral, panklar, catvoit, tozolin and others) should be classified among the most widespread and potent stimulants of work capacity and operator activity.

Stimulants of the phenamine type have a cumulative effect, which limits the possibility of using them repeatedly. They accelerate metabolism and overall expenditure of energy reserves. This is associated with an increase in oxygen uptake, elevation of body temperature, decreased endurance of oxygen shortage, decreased reserves of glycogen and fat, etc. An increase in dosage or repeated administration of products of the phenamine class during considerable physical exercise, against the background of depletion of resources and reservoirs of catecholamines, could lead to development of acute cardiac insufficiency and myocardial infarction. This explains the cases of death among athletes who took phenamine and analogues thereof as doping. The adverse properties of phenamine and products similar to it include development of addiction, individuality of reactions (paradoxical effect in 10-15% of the cases), loss of appetite and marked vegetative changes. These adverse properties make it impossible to take phenamine and analogues thereof regularly as stimulants during intensive physical and mental work. Thus, in spite of the fact that products of the phenamine type are the most potent and reliable stimulants of physical and mental work capacity, they can be recommended only for one-time intake in emergency cases, in the presence of critical situations.

Foreign-made patented stimulants (mefexamide, panklar, lucidryl, euclidin and others) are widely used in Italy and France to eliminate or prevent fatigue. These agents, which are referable to different classes of chemical compounds, have been submitted to little clinical and pharmacological study.

In recent years, reports of a new class of stimulants have been published, a representative of which is gutimin (A. V. Pastusheniov, 1968; V. V. Parin et al., 1969a). Unjustifiably little attention is being given to ephedrine as a stimulant of the phenylethylamine type. It is not by chance that Chinese emperors have always been depicted with an ephedra branch in the hand, as a symbol of power and longevity. Strychnine is not generally used as a stimulant, but there are data indicative of its capacity to enhance the body's resistance to space flight factors (V. V. Parin et al., 1964), as well as physical loads (V. Ye. Belay et al., 1970). We consider it

warranted to continue experimental research on the stimulant properties of ephedrine and strychnine, as well as a combination thereof (N. V. Gordeycheva et al., 1975).

The data concerning analeptics proper (bemegrade, corazole), particularly caffeine, for use as stimulants are contradictory. Corazole, bemegrade and picrotoxin are rather toxic, and there have been few studies of their psychostimulant effect when used in safe doses. On the other hand, the pharmacological properties of caffeine have been studied so well, that they require no discussion. General tonic agents of the ephedrine, strychnine and caffeine types are quite physiological; their main action is directed toward stimulating metabolism and work capacity (A. F. Krasnova and N. R. Chagovets, 1961; V. Ya. Rusin and G. V. Trefelov, 1966; I. M. Borisov, 1968; N. I. Vol'nov et al., 1968).

The problem of enhancing efficiency pharmacologically is not limited to a search for synthetic stimulants. In the last 10 years there has been a tendency toward investigation and use of tonic products of plant origin during intensive physical exercise. N. V. Lazarev proposed the name of adaptogens for plants products that induce a state of increased nonspecific resistance. The capacity of adaptogens (ginseng, eleuterococcus, leuzea, rhododin, acanthopanax root, substances extracted from Saiga horns) to enhance work capacity has been described in the works of I. I. Brekhman (1962), I. I. Brekhman and O. I. Kirillov (1966), A. V. Zvereva (1965) and others.

In the event it is necessary to use pharmacological agents to increase work capacity of cosmonauts, we can apparently only be referring to "mild"-acting stimulants, adaptogens and tonics. With occurrence of an accident [or emergency situation], as well as when it is necessary to drastically increase work capacity, the use of "superdoping," adaptogens, stimulants of redox processes in tissues is justified from the point of view of the pharmacologists.

Evidently, it will also be necessary to take pharmacological agents when returning to earth from long-term flights in order to enhance resistance to accelerations, as well as readaptation processes (P. V. Vasil'yev and A. R. Kotovskaya, 1965; P. V. Vasil'yev et al., 1969; V. Ye. Belay et al., 1967a, b).

Pharmacological regulation of sleep-waking cycles and emotional stress: The subject sensations occurring during space flights, particularly long-term ones, include emotions, dreams, illusions, fantasies and hallucinations. They are important from the standpoint of retaining a high level of efficiency and vital functions of a cosmonaut. The phenomena reflecting signs of neuroemotional stress and fatigue have not affect the outcome of missions substantially thus far. As an example, we can mention the results of the Apollo-13 mission, the courageous crew of which, in spite of exceptional emotional stress, successfully returned their "wounded" craft to earth (D. Lindsley, 1974).

More or less marked sleep disorders were objectively observed in a number of studies dealing with the effects of isolation. The severity of sleep disorders increased with increase in duration of isolation (D. Lindsley, 1974). The accounts of cosmonauts who have participated in long-term flights are also indicative of sleep disturbances (Berry, 1970). Ultimately, a shortage of sleep could affect performance of some important tasks (Johnson, 1969; Naitoh, 1969). However, many aspects of this problem have not yet been sufficiently studied, and this is related to some extent to the shortage of objective data on the nature of disturbances referable to sleeping and waking cycles during long-term space flights. For this reason, the question of using products with psychosedative and sedative action merits special attention. A practical solution has been found at the present time, with regard to the use of pharmacological agents with psychosedative and hypnotic action; such products are included in the onboard medicine chests of spacecraft and orbital stations. The status of the problem of developing psychosedative agents has been described rather comprehensively by P. V. Vasil'yev et al. (1977).

As we know, regular sleep can have a decisive influence on the results of a long-term space flight. Monotonous operator activity at a pace set by the work process is particularly susceptible to the adverse effect of a shortage of sleep. Decreased vigilance and poorer results of long-term tests have been found in subjects who had slept for less than 3 h the night before the tests (Wilkinson, 1968). Insufficient sleep has an adverse effect on procedures involving constant monitoring of instrument readings and signals that require rapid and accurate decision making.

Weightlessness and related change in impulsion from proprioceptive and exteroceptive receptors, as well as altered afferentation from muscles, are the main factors that can induce substantial changes in sleep during a space flight, its quality, duration, proportion of phases and depth (V. P. Zukhar', 1968), which was demonstrated in experiments involving prolonged isolation and immersion in water. Of the vast group of hypnotics, it is preferable to use agents during space flights that have different effects on sleep periods (sleep structure). Apparently, preference should be given to agents that affect mainly the falling asleep phase and induce sleep that is as similar as possible to physiological sleep (V. V. Parin et al., 1969a, b), as well as "daytime" tranquilizers, which can be considered the hypnotics of choice. P. V. Vasil'yev et al. (1971) believe that hypnotics with medium duration of action are the most promising for use during space flights. Long-acting hypnotics are unsuitable, since they all have side-effects and sequelae, which are related to slow elimination thereof and cumulative properties.

One should proceed with great caution in the use of hypnotics in general and during space flights in particular. Most of them alter significantly the nature of an individual's typical sleep; not infrequently, they lose their efficacy after prolonged use (Kales et al., 1968).

Conclusion

The knowhow gained by clinical medicine, the achievements of pharmacology, pharmaceuticals and pharmaceutical chemistry have handed medical science a large number of effective drugs, which can intervene in the systems of regulation and vital functions of the body, in the presence of functional disturbances or pathology.

The data presently available indicate convincingly that it is possible, in principle, to make effective use of drugs to enhance resistance to the extreme factors of space flights. At the same time, formulation and preparation of the composition of drugs for onboard medicine kits require experimental substantiation, with due consideration of the specifics of their action in weightlessness, route of administration, stability during storage, possibility of repeated intake, etc. It will also be necessary to synthesize new specific products, with subsequent extensive experimental and clinical investigation thereof.

We have not discussed here other groups of drugs, which have been and will continue to be included in onboard medicine chests (analgesics, antipyretics, antihistamines, radioprotective agents, antitussives, anesthetics, laxatives, etc.), fluids for parenteral injections and therapeutic procedures. These data are contained in publications of Soviet and foreign authors (I. S. Gurin et al., 1968; V. V. Parin et al., 1969a, b; P. P. Saksonov et al., 1968, 1976; N. N. Suvorov and V. S. Shashkov, 1975; P. V. Vasil'yev et al., 1971; Berry, 1965; Drovak, 1972; Donatelli, 1969). But even the special problems of space pharmacology we have listed require special investigation: limited space and weight of flying vehicles and the specific conditions of weightlessness limit the possibilities and scope of medical care.

It should be stressed that the advances of space medicine were instrumental in solving a number of problems of medical science as a whole (A. I. Burnazyan et al., 1977). This applies to determination of the range of normal and pathology, refinement of methods of expert evaluation of the health status of man, development of miniaturized and precise equipment with continuous biotelemetric transmission of data, etc. Unquestionably, space pharmacology will make a contribution to the development of experimental and clinical pharmacology.

BIBLIOGRAPHY

1. Anashkin, O. D.; Martynov, A. I.; Trushinskiy, Z. K.; et al. SOV. MED. [Soviet Medicine], No 1, 1977, p 107.
2. Balakhovskiy, I. S., and Natochin, Yu. V. in "Problemy kosmicheskoy biologii" [Problems of Space Biology], Moscow, Vol 22, 1973, p 89.
3. Belay, V. Ye.; Vasil'yev, P. V.; and Glod, G. D. Ibid, Vol 6, 1967, p 124.

4. Belay, V. Ye.; Vasil'yev, P. V.; and Glod, G. D. KOSMICHESKAYA BIOL. [Space Biology], No 3, 1967, p 15.
5. Idem, Ibid, No 1, 1970, p 77.
6. Biryukov, Ye. N., and Krasnykh, I. G. Ibid, No 6, p 42.
7. Borisov, I. M. "Investigation of the Body's Retinol Requirement During Physical Exercise," candidatorial dissertation, Moscow, 1968.
8. Brekhman, I. I. in "Simpozium po eleuterokokku i zhen'shenyu" [Symposium on Eleuterococcus and Ginseng], Vladivostok, 1962, p 36.
9. Brekhman, I. I., and Kirillov, O. I. "Tsentral'nyy NII fizicheskoy kul'tury. Itogovaya nauch. sessiya za 1965" [Summary Scientific Session for 1965 of the Central Scientific Research Institute of Physical Culture], proceedings, Moscow, 1966, p 232.
10. Bryanov, I. I.; Yemel'yanov, M. D.; Matveyev, M. D.; et al. in "Kosmicheskiye polety na korabliakh 'Soyuz'" [Space Flights Aboard Soyuz Aircraft], edited by O. G. Gazenko, L. I. Kakurin and A. G. Kuznetsov, Moscow, 1976, p 195.
11. Burnazyan, A. I.; Vorob'yev, Ye. I.; Gazenko, O. G.; et al. KOSMICHESKAYA BIOL., No 5, 1977, p 3.
12. Vasil'yev, P. V., and Glod, G. D. Ibid, No 3, 1977, p 3.
13. Vasil'yev, P. V.; Kas'yan, I. I.; and Pestov, I. D. IZV. AN SSSR. SER. BIOL. [News of the USSR Academy of Sciences, Biology Series], No 3, 1969, p 323.
14. Vasil'yev, P. V., and Kotovskaya, A. R. in "Osnovy kosmicheskoy biologii i meditsiny" [Fundamentals of Space Biology and Medicine], Moscow, Vol 2, Bk 1, 1975, p 177.
15. Vasil'yev, V. P., and Lapinskaya, B. Yu. in "Problemy kosmicheskoy biologii," Moscow, Vol 13, 1969, p 206.
16. Volozhin, A. I. "Pathogenesis of Disturbances of Calcium Metabolism in Mineralized Tissues During Long-Term Hypokinesia," author abstract of doctoral dissertation, Moscow, 1977.
17. Vol'nov, N. I.; Leshkevich, L. G.; and Yakovlev, N. N. in "Tsivilizatsiya, sport i serdtse" [Civilization, Sports and the Heart], Moscow, 1968, p 60.
18. Vorob'yev, Ye. I.; Yegorov, A. D.; Kakurin, L. I.; et al. KOSMICHESKAYA BIOL., No 6, 1970, p 26.

19. Vorob'yev, Ye. I.; Nefedov, Yu. G.; Kakurin, L. I.; et al. Ibid, No 4, 1969, p 46.
20. Ginetsinskiy, A. G. "Physiological Mechanisms of Fluid-Electrolyte Equilibrium," Moscow--Leningrad, 1964.
21. Gozulov, S. A., and Frolov, N. I. KOSMICHESKAYA BIOL., No 4, 1969, p 67.
22. Gordeycheva, N. V.; Shashkov, V. S.; Kaplan, E. Ya.; et al. Ibid, No 5, 1975, p 6.
23. Grigor'yev, A. I. FIZIOL. ZH. SSSR [Physiological Journal of the USSR], Vol 58, No 6, 1972, p 828.
24. Grigor'yev, A. I., and Kozyrevskaya, G. I. KOSMICHESKAYA BIOL., No 5, 1970, p 55.
25. Grigor'yev, A. I.; Kozyrdvskaya, G. I.; Natochin, Yu. V.; et al. in "Kosmicheskie polety na korablyakh 'Soyuz'," edited by O. G. Gazenko, L. I. Kakurin and A. G. Kuznetsov, Moscow, 1976, p 266.
26. Gurin, I. S.; Davydov, B. I.; Divin, Ya. N.; et al. KOSMICHESKIYE ISSLEDOVANIYA [Space Research], Vol 6, No 5, 1968, p 782.
27. Gurovskiy, N. N., and Yegorov, A. D. KOSMICHESKAYA BIOL., No 6, 1976, p 3.
28. Zvereva, A. V. in "Khabarovskiy med. in-t. Nauchnaya konf. 22-ya. Materialy" [Proceedings of 22d Scientific Conference of Khabarovsk Medical Institute], Khabarovsk, 1965, p 219.
29. Kakurin, L. I., and Biryukov, Ye. N. in "Problemy kosmicheskoy meditsiny" [Problems of Space Medicine], Moscow, 1966, p 187.
30. Kakurin, L. I.; Grigor'yev, A. I.; and Kozyrevskaya, G. I. in "Mezhdunarodnyy astronavticheskiy kongress. 24-y. Trudy" [Proceedings of 24th International Astronautical Congress], Baku, 1973, p 199.
31. Kakurin, L. I.; Katkovskiy, B. S.; Mikhaylov, V. M.; et al. in "Kosmicheskiye polety na korablyakh 'Soyuz'," edited by O. G. Gazenko, L. I. Kakurin and A. G. Kuznetsov, Moscow, 1976, p 230.
32. Kassil', G. N., and Polyakov, B. I. FIZIOLOGIYA CHELOVEKA [Human Physiology], No 4, 1977, p 614.
33. Kovalenko, Ye. A. KOSMICHESKAYA BIOL., No 4, 1977, p 3.

34. Kozyrevskaya, G. I.; Grigor'yev, A. I.; and Dorokhova, B. R. in "Vsesoyuznaya konf. po vodno-solovomu obmenu i funktsii pochek. 4-ya. Materialy" [Proceedings of 4th All-Union Conference on Fluid-Electrolyte Metabolism and Renal Function], Chernovtsy, 1974, p 148.
35. Kolemeyeva, L. Ya., and Shashkov, V. S. KOSMICHESKAYA BIOL., No 4, 1974, p 14.
36. Kolemeyeva, L. Ya.; Shashkov, V. S.; and Yegorov, B. B. Ibid, No 6, 1975, p 78.
37. Idem, Ibid, No 2, 1977, p 74.
38. Kravchuk, L. A., and Ovechkin, V. G. Ibid, No 3, 1968, p 7.
39. Krasnova, A. F., and Chagovets, N. R. UKR. BIOKHM. ZH. [Ukrainian Biochemical Journal], No 3, 1961, p 402.
40. Lukomskaya, N. Ya., and Nikol'skaya, M. I. "Search for Drugs Against Seasickness," Leningrad, 1971.
41. Mirzoyan, R. S. "Pharmacology of Adrenergic Regulation of Cerebral Circulation," author abstract of doctoral dissertation, Moscow, 1977.
42. Parin, V. V.; Vinogradov, V. M.; and Razumeyev, A. N. KOSMICHESKAYA BIOL., No 1, 1969, p 20.
43. Parin, V. V., and Fedorov, B. M. in "Aviatsionnaya i kosmicheskaya meditsina" [Aviation and Space Medicine], Moscow, Vol 2, 1969, p 116.
44. Parin, V. V.; Fedorov, B. M.; and Nevstruyeva, V. S. DOKL. AN SSSR [Reports of the USSR Academy of Sciences], No 1, 1969, p 250.
45. Pastushenkov, A. V. "Effect of Some Antihypoxia Agents and Central Nervous System Stimulants on Physical Work Capacity Under Hypoxic Conditions," candidatorial dissertation, Leningrad, 1968.
46. Pestov, I. D., and Geratevol', S. Dzh. in "Osnovy kosmicheskoy biologii i meditsiny," Moscow, Vol 2, Bk 1, 1975, p 324.
47. Rusin, V. Ya., and Treferlov, G. V. in "Tomskiy med. in-t. Tsentral'naya nauchn.-issled laboratoriya. Konferentsiya. 3-ya. Materialy" [Proceedings of 3d Conference of Central Scientific Research Laboratory of Tomsk Medical Institute], Tomsk, Pt 3, 1966, p 116.
48. Saksonov, P. P.; Antipov, V. V.; and Davydov, B. I. "Essays on Space Radiobiology," Moscow, 1968.
49. Saksonov, P. P.; Antipov, V. V.; Dobrov, N. N.; et al. in "Problemy kosmicheskoy biologii," Moscow, Vol 4, 1965, p 119.

50. Saksonov, P. P.; Shashkov, V. S.; and Sergeyev, P. V. "Radiation Pharmacology," Moscow, 1976.
51. Smit, A. G. in "Osnovy kosmicheskoy biologii i meditsiny," Moscow, Vol 2, Bk 1, 1975, p 141.
52. Suvorov, N. N., and Shashkov, V. S. "Chemistry and Pharmacology of Radioprotective Agents," Moscow, 1975.
53. Tigranyan, R. A.; Kalita, N. F.; and Popova, I. A. KOSMICHESKAYA BIOL., No 2, 1977, p 48.
54. Shashkov, V. S.; Vasin, M. V.; Saksonov, P. P.; et al. FARMAKOL. I TOKSIKOL. [Pharmacology and Toxicology], No 1, 1967, p 109.
55. Shashkov, V. S., and Gordeycheva, N. V. KOSMICHESKAYA BIOL., No 2, 1972, p 3.
56. Shashkov, V. S.; Gordeycheva, N. V.; Lakota, N. G.; et al. in "Aviakosmicheskaya meditsina" [Aerospace Medicine], Moscow--Kaluga, Vol 2, 1975, p 205.
57. Idem, in "Problemy vosstanovleniya rabotosposobnosti sportsmenov posle vysokikh trenirovochnykh nagruzok" [Problems of Recovery of Work Capacity of Athletes After Heavy Training Practice] [no year].
58. Shashkov, V. S.; Dmitriyev, B. S.; Volozhin, A. I.; et al. KOSMICHESKAYA BIOL., No 3, 1974, p 18.
59. Shashkov, V. S., and Yegorov, B. B. in "Vsesoyuznyy biokhimicheskiy s"yezd. 3-y. Tezisy simpozial'nykh dokladov" [Summaries of Papers Delivered at Symposiums of the 34 All-Union Biochemical Congress], Riga, 1974, p 318.
60. Shashkov, V. S.; Yegorov, B. B.; Dmitriyev, B. S.; et al. FIZIOL. ZH. SSSR, Vol 60, No 2, 1974, p 240.
61. Berry, Ch. A. ANN. OTOL. (St. Louis), Vol 70, 1961, p 418.
62. Idem, J. AM. PHARM. ASS., Vol 5, 1965, p 358.
63. Idem, SCI. J., Vol 5, 1969, p 103.
64. Idem, AEROSAPCE MED., Vol 40, 1969, p 245.
65. Idem, Ibid, Vol 41, 1970, p 500.
66. Idem, in "Man in Space," Moscow, 1974, pp 51-75.

67. Berry, Ch. A.; Coons, D. O.; Catterson, A. D.; et al. in "Gemini Midprogram Conference Including Experiment Results," Washington D. C., NASA Sp-121, 1966, p 235.
68. Bohnn, B. H.; Kamenetsky, L. G.; Colder, B. E.; et al. in "Aerospace Medical Association 40th Annual Meeting," San Francisco, 1969, p 13.
69. Brand, J. J., and Perry, W. L. M. PHARMACOL. REV., Vol 18, 1966, p 895.
70. Brandt, Th.; Dichgans, J.; and Wagner, W. AEROSPACE MED., Vol 45, 1974, p 1291.
71. Busby, D. E. "A Prospective Look at Medical Problems From Hazards of Space Operations," NASA CR-856, Washington, 1967.
72. Donatelli, L. D. MINERVA MED., Vol 60, 1969, p 843.
73. Dvorak, J. CSL. FYSIOL., Vol 21, 1972, p 323.
74. Eliot, R. S., and Forker, A. D. J.A.M.A., Vol 236, 1976, p 2325.
75. Epstein, M., and Saruta, T. J. APPL. PHYSIOL., Vol 31, 1971, p 368.
76. Gauer, O. H.; Eckert, P.; Kaiser, D.; et al. in "International Symposium on Basic Environmental Problems of Man in Space, 2d," Paris, 1965, p 212.
77. Giovanni, C. D., and Birkhead, N. C. AEROSPACE MED., Vol 35, 1964, p 225.
78. Graybiel, A. ASTRONAUT. ACTA, Vol 17, 1972, p 5.
79. Hattner, R. C., and McMillan, D. E. AEROSPACE MED., Vol 39, 1968, p 894.
80. Hunt, N. C. Ibid, Vol 38, 1967, p 176.
81. Johnson, R. C. in "Sleep, Physiology and Pathology," edited by A. Kales, New York, 1969, p 206.
82. Idem, in "Skylab Life Sciences Symposium. Proceedings," Houston, Vol 1, 1974, p 1.
83. Kales, A.; Lingtan, T.; Schars, M. B.; et al. PSYCHOPHYSIOLOGY, Vol 5, 1968, p 205.
84. Kennedy, R. S.; and Graybiel, A. AEROSPACE MED., Vol 33, 1962, p 935.
85. Kervin, J. G. "Report to NASA-NRC Committee on Long-Duration Space Flight," Manned Spaceflight Center, Houston, 1969.

86. Idem, in "Skylab Life Sciences Symposium. Proceedings," Houston, Vol 1, 1974, p 55.
87. Lynch, T. N.; Jensen, R. L.; Stevens, P. M.; et al. AEROSPACE MED., Vol 38, 1967, p 10.
88. Natchin, Y. V.; Kozyrevskaja, G. I.; and Grigoryev, A. I. in "International Symposium on Man in Space. 5th," Washington, 1973, p 8.
89. Schmidt, C. F. J. AM. PHARM. ASS., Vol 5, 1965, p 361.
90. Shashkov, V. S.; Kakurin, L. I.; Egorov, B. B.; et al. in "International Astronautical Federation Congress, 28th," Prague, 1977, p 53.
91. Stevens, P. M., and Lynch, T. N. AEROSPACE MED., Vol 36, 1965, p 1151.
92. Stevens, P. M.; Lynch, T. N.; Johnson, R. L.; et al. Ibid, Vol 37, 1966, p 1049.
93. Wilkinson, R. T. PROGR. CLIN. PSYCHOL., Vol 8, 1968, p 28.
94. Wood, Ch. D., and Graybiel, A. AEROSPACE MED., Vol 39, 1968, p 1341.
95. Wynston, L. K., and Perkins, D. L. Ibid, Vol 39, p 966.
96. Wynston, L. K.; Perkins, D. L.; Streimer, J.; et al. Ibid, Vol 38, 1967, p 690.
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DISEASES OF THE NERVOUS SYSTEM AS A CAUSE OF LOSS OF WORK CAPACITY AMONG
KOLKHOZ WORKERS

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[Text] The decisions of the July (1978) Plenary Session of the CPSU Central Committee point toward a search for and use of reserves of accelerated development of agricultural production. A significant reserve for increasing labor productivity and agricultural products is to reduce the incidence of disease with temporary loss of work capacity of kolkhoz members, based on extensive study of its principles.

Diseases of the nervous system occupy one of the first positions among the causes of temporary work incapacity of kolkhoz workers. The sick rate of industrial workers with diseases of the nervous system with temporary loss of work capacity has been analyzed in a large number of publications (I. V. Polyakov; M. G. Garina and so on). However, we have not found similar papers devoted to kolkhoz workers, which also predetermined selection of the topic of this investigation.

Relying on materials of official records, we conducted an extensive study of the sick rate with diseases of the nervous system with temporary loss of work capacity among 9,300 kolkhoz workers of 19 kolkhozes of Tel'manovskiy Rayon of Donetskaya Oblast over a period of 5 years (1972-1976). The list of diseases of the nervous system, the incidence of which was studied besides the diseases, injuries and causes of death of the eighth reexamination provided by international classification, included vascular afflictions of the cerebrum (insult and temporary disruption of cerebral circulation), which comprised one group with inflammatory diseases of the central nervous system, and vertebrogenic lumbosacral radiculitis. Elimination of vertebrogenic lumbosacral radiculitis from the diseases of the lumbosacral region of the peripheral nervous system would lead to distortion of the existing concept about the leading role of this disease among the causes of temporary work incapacity and would reduce its significance as a social and hygienic problem.

Mean annual data on the sick rate of 1,854 patients who presented 2,099 cases of work incapacity and the number of full-time kolkhoz workers who had worked the annual work time reserve (280 days) on the kolkhoz and who have medical insurance, were used in calculating the indices of temporary work incapacity. The method of calculating the indices of temporary work incapacity among kolkhoz workers was described previously (V. V. Kuptsov, 1975, 1977).

Table 1. Indices of Temporary Work Incapacity with Some Diseases Among Kolkhoz Workers

(1) Причина нетрудоспособности	(2) На 100 колхозников		(3) Ранжирующая шкала		(6) Средняя длина болезни в днях
	(4) случаев	(5) дней	случаев	дней	
(7) Острые респираторные инфекции	6.1±0.2	41.9	1-е	3-е	6.8
(8) Болезни нервной системы	4.6±0.2	62.6	2-е	1-е	13.5
(9) Грипп	3.9±0.2	21.8	3-е	7-е	5.5
(10) Инфекции кожи и подкожной клетчатки	2.6±0.16	30.5	4-е	6-е	11.8
(11) Несчастные случаи, отравления и травмы в связи с производством	2.2±0.15	44.4	5-6-е	2-е	19.7
(12) Болезни костно-мышечной системы	2.2±0.15	34.3	5-6-е	5-е	15.3
(13) Несчастные случаи, отравления и травмы в быту	2.0±0.15	39.0	7-е	4-е	18.9
Всего (14)	38.5±0.6	557.9			11

Key:

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| 1. Cause of work incapacity | 9. Influenza |
| 2. Per 100 kolkhoz workers | 10. Infections of the skin and subcutaneous tissue |
| 3. Rank positions | 11. Accidents, poisonings and injuries with regard to production |
| 4. Cases | 12. Diseases of the osteomuscular system |
| 5. Days | 13. Accidents, poisonings and injuries off the job |
| 6. Average length of 1 case of illness | |
| 7. Acute respiratory infections | |
| 8. Diseases of the nervous system | |
| 14. Total | |

Data on the main causes of temporary work incapacity among kolkhoz workers are presented in Table 1. The fraction of these causes, according to our data, comprise 61.9 percent in total complexity of all cases and 49.6 percent of days lost due to disease. Among these illnesses, diseases of the nervous system are determined by higher intensive indicators, occupying second place in the level of incidence (4.6 ± 0.22 cases) and first place among the number of days of work incapacity (62.6) per 100 kolkhoz workers (the difference of the indices is statistically reliable; $P < 0.01$). The specific rate of

neurological illness in the total sick rate of kolkhoz workers with temporary work incapacity comprises 11.9 percent in cases and 11.2 percent in days.

Analysis of the incidence of diseases of the nervous system showed that the main reason for temporary work incapacity among kolkhoz workers are diseases of the peripheral nervous system having higher intensive indices (3.9 ± 0.2 patients, 4.5 ± 0.22 cases and 57.7 days per 100 persons) and which yield 96.1 percent of all those suffering from diseases of the nervous system, 96.4 percent of cases of illness and 92.1 percent of days of work incapacity (Table 2).

Among this group, which combines different diseases of the nerves and peripheral ganglia, lumbosacral radiculitis is distinguished by the highest level of incidence (3.0 ± 0.7 in personnel and 3.4 ± 0.19 in cases). It also results in the longest loss of days of work incapacity (42.7 days per 100 kolkhoz workers). The indices of their sick rate are as follows: 72.9 percent of all those suffering from diseases of the nervous system, 73.8 percent of cases and 68.2 percent of days of work incapacity in the structure of the incidence of diseases of the peripheral nervous system, 76.0, 76.5 and 74.2 percent, respectively.

The frequency of all the remaining groups of diseases of the nervous system is characterized by tenths and hundredths of personnel and the cases do not exceed 6.9 days per 100 kolkhoz workers, far below the indices of the frequency of lumbosacral radiculitis. Low distribution indices are also inherent to these groups of diseases: from 1 to 10.2 percent in the structure of patients and cases and from 1.8 to 11.0 percent in the structure of days of work incapacity.

The average length of one case of temporary work incapacity due to diseases of the nervous system, according to our data, comprises 13.5 ± 0.19 days. It is highest with vascular and inflammatory diseases of the brain (31.3 ± 4.1 days) and also with miscellaneous diseases of the nervous system (25.5 ± 5.56 days; $P > 0.05$) and is least among diseases of the nerves and peripheral ganglia (12.9 ± 0.1 days), including 12.5 ± 0.13 days ($P < 0.5$; < 0.01) with lumbosacral radiculitis.

Sex and age have a specific effect on the incidence of diseases of the nervous system among kolkhoz workers with temporary loss of work capacity (Table 3). It is obvious from Table 3 that males lose work capacity more frequently than females (5.2 ± 0.33 and 4.0 ± 0.29 cases per 100 kolkhoz workers, respectively; $P < 0.05$) and have higher indices of sickness among all age groups (statistically, the difference of indices is confirmed only in the group of 50 years and older; $P < 0.05$). Persons of both sexes with greatest frequency of work incapacity are recorded in age of 30-39 and 40-49 years. The fraction of these age groups comprise 74.7 percent of all cases and 75.1 percent of days of work incapacity.

Table 2. Frequency of Neurological Incidence of Disease Among Kolkhoz Workers with Temporary Loss of Work Capacity (Per 100 Kolkhoz Workers) and its Structure

Заболевание (1)	(2) Болезни		(3) Случаи		(4) Дни		Средняя длитель- ность 1 случая за- болевания (6)
	абс. (5)	%	абс.	%	абс.	%	
Сосудистые и воспалитель- ные заболевания головного мозга (7)	1.1±0.03	2.8	0.1±0.03	2.6	3.8	6.1	31.3±4.1
Заболевания нервов и перифе- рических ганглиев: (8)	4.4±0.2	96.1	4.5±0.22	96.4	57.7	92.1	12.9±0.1
пояснично-крестцовый радикулит (9)	4.0±0.17	72.9	3.4±0.19	73.8	42.7	68.2	12.5±0.13
заболевания нервов и спле- чий верхних конеч- ностей (10)	0.4±0.05	6.4	0.3±0.056	6.0	3.8	6.1	13.9±0.33
другие болезни перифе- рических нервов (11)	0.42±0.07	10.4	0.5±0.07	10.2	6.9	11.0	14.5±0.76
(12) ангиовегетодистония	0.25±0.05	6.4	0.3±0.05	6.4	4.3	6.8	14.3±0.56
Прочие заболевания нервной системы (13)	0.04±0.02	1.1	0.04±0.02	1.0	1.1	1.8	25.5±5.56
Итого (14)	4.1±0.2	100.0	4.6±0.22	100.0	62.6	100.0	13.5±0.19

Key:

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| 1. Diagnosis | 9. Lumbosacral radiculitis |
| 2. Patients | 10. Diseases of the nerves and plexus of the upper extremities |
| 3. Cases | 11. Other diseases of the peripheral nerves |
| 4. Days | 12. Angiovegetodistonia |
| 5. Absolute | 13. Miscellaneous diseases of the nervous system |
| 6. Average length of 1 case of disease | 14. Total |
| 7. Vascular and inflammatory diseases of the brain | |
| 8. Diseases of the nerves and peripheral ganglia | |

Table 3. Frequency of Sick Rate of Workers with Diseases of the Nervous System with Temporary Work Incapacity (Per 100 Persons) and its Structure as a Function of Age and Sex

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age, years									
Up to 30		2.0 ± 0.17	1.8 ± 0.10	1.9 ± 0.11	2.1	1.1	1.1		
31-40		6.8 ± 0.28	5.6 ± 0.68	6.1 ± 0.41	20.3	12.9	11.1		
41-50		6.6 ± 0.40	4.4 ± 0.41	5.0 ± 0.28	11.1	11.7	11.1		
50 and older		8 ± 0.8	7.6 ± 0.70	7.8 ± 0.49	50.9	14.6	11.8		
Total		5.2 ± 0.34	4.0 ± 0.29	4.6 ± 0.27	100.0	100.0	100.0		

Key:

1. Age, years
2. Number of cases of illness
3. In percent of total
4. Males
5. Females
6. Both sexes
7. Up to
8. 50 and older
9. Total

The group indices of the frequency of cases correspond to indices of the number of days which are 1.3-2.2 times higher among males than among females, with the exception of persons up to 30 years old. The number of days of work incapacity is somewhat higher among females of this age group than among males.

The presence of a direct mean relationship between age and the frequency of cases and days of work incapacity among males ($\rho = +0.4$) and the direct weak relationship among females and persons of both sexes ($\rho = +0.2$) was established by using the Spirmen method. Moreover, the age of males affects the average length of one case of work incapacity ($\rho = +0.8$); it was not possible to establish this function among females.

The occupation and length of work service have the most significant effect on the sick rate of kolkhoz workers, along with sex and age. The highest indices of temporary work incapacity occur among machine operators (5.7 ± 0.59 in persons, 6.5 ± 0.65 in cases and 89.8 in days) and they comprise 3.2 ± 0.42 , 3.6 ± 0.46 and 49.0, respectively, among kolkhoz workers of miscellaneous occupations. The indices of the sick rate of livestock breeders, plant growers and drivers hardly differ from each other: the number of sick persons fluctuates from 3.6 to 4.1, the number of cases fluctuates from 4.2 to 4.7 and the number of days fluctuates from 58.7 to 64.1. All the indices are highest among drivers. Standardization of the indicators did not change the ratio in the level of illness of representatives of different occupational groups. The statistically reliable excess of indicators of the sick rate of machine operators ($P < 0.05$; < 0.01) above those of kolkhoz workers of other occupations (except drivers) indicates the significance of differences in their working conditions.

The intensity of the illness and the number of days of work incapacity lost with regard to diseases of the nervous system are a direct function of the length of work service. This principle is most distinct among representatives of those occupations (tractor operators, milkmaids and drivers) whose labor is accompanied by different unfavorable factors related etiologically to some diseases of the nervous system (vibration, statistical and dynamic stress of individual muscular groups, unfavorable meteorological conditions and so on).

Thus, the indices of cases and days of working capacity due to diseases of the peripheral nervous system were 3.5-4.0 times higher among tractor operators with length of work service of more than 15 years in their specialty than among tractor operators with length of work service of 1-5 years and were 1.3-1.5 times higher compared to indices in groups with length of work service of 6-10 and 11-15 years.

The effect of occupational length of service on sick rate is manifested especially clearly upon comparison of the indices of groups with length of service of 1-5 and 6-10 years among plant breeders, compared to the sick rate of representatives of groups with total length of work service of 5-14 and 15-24 years. Use of the χ^2 method confirmed with high degree of probability ($P < 0.01$) the effect of occupational and total length of work service on the level of illness (in cases) of kolkhoz workers of all occupations with diseases of the peripheral nervous system, resulting in temporary loss of work capacity. At the same time, it was established that the occupation and length of service has no appreciable effect on the average length of one case of disease.

Our data indicate the marked seasonal nature of neurological illness among kolkhoz workers. Its peak arrives during the spring-summer season. It is important to note that kolkhoz workers of different occupations have different seasonal fluctuations of sick rate. Thus, the rise of the sick rate among machine operators is related not only to chilling, but, which is no less important, to periods of the highest intensification of their labor during spring plowing and spring field operations. Except for November-December, an increased level of sick rate is also noted in March and May among plant breeders, i.e., at the beginning of spring field operations and during the height of weeding.

Thus, an increase of illness during individual periods of the year is determined not only by unfavorable meteorological conditions, but also by the specifics of agricultural labor.

The duration of one case of illness with diseases of the nervous system mainly depends on its nature. Brief work incapacity (1-3 days) is generally not recorded in vascular and inflammatory diseases of the brain and also with miscellaneous diseases of the nervous system, and the percentage of cases of illness lasting 30 days or more comprises 36.4 and 23.8, respectively. Temporary work incapacity most frequently lasts for 8-14 days (in 50.6 percent of cases) with diseases of the peripheral nervous system. This duration is

52.7 percent of cases of illness with lumbosacral radiculitis and from 40.7 to 49.6 percent of cases with other diseases of the nerves and peripheral ganglia. With the total low percentage of cases of illness lasting 1-3 days (1.2 percent), their fraction comprises 11.1 percent among kolkhoz workers with lumbosacral radiculitis. Although these data are close to those of the literature (M. G. Garina; I. V. Polyakov and so on), they nevertheless make one cautious with respect to the quality of expert analysis of temporary work incapacity due to lumbosacral pain.

The multiplicity of loss of work capacity also depends on the nature of affliction of the nervous system. It is highest with lumbosacral radiculitis (1.14), followed by angiovegetodystonia (1.12) and other diseases of the peripheral nerves (1.11). This coefficient is equal to 1.13 for the entire group of diseases of the peripheral nervous system.

Diseases of the nervous system are one of the main causes of prolonged and frequent illnesses of kolkhoz workers with temporary loss of work capacity. According to our data, the group of prolonged and frequently ill persons numbered 123 persons--83 (67.5 percent) of males and 40 (32.5 percent) of females. All the patients of the indicated group were in it for no more than 2 years (91.9 percent for 1 year and 8.1 percent for 2 years). The composition of the group is as follows: prolonged illness--69.9 percent, frequently ill--4.1 percent and prolonged and frequently ill--26.0 percent. The structure of illness of prolonged and frequently ill is as follows: vascular and inflammatory diseases of the brain--13 percent, diseases of the nerves and peripheral ganglia--81.3 percent, including lumbosacral radiculitis--61.0 percent and miscellaneous diseases of the nervous system--5.7 percent.

A prolonged course of the illness (30 days or more) was found among all diseases of the nervous system, whereas only persons suffering with lumbosacral radiculitis were most frequently ill. Patients with diseases of the peripheral nervous system (mainly with lumbosacral radiculitis) formed the subgroup of prolonged and frequently ill. The prolonged and frequently ill comprise 6.6 percent of all those suffering with diseases of the nervous system, but they comprise 10.9 percent of all cases and 24 percent of working days lost with regard to the pathology of this type, which requires adoption of effective measures for recovery of kolkhoz workers contained in this group.

We calculated the annual economic loss inflicted on the national economy by illness of kolkhoz workers with diseases of the nervous system with temporary loss of work capacity. It comprised 65,600 rubles for the rayon (9.8 percent of the economic loss was by temporary work incapacity of kolkhoz workers) and the loss due to illness with lumbosacral radiculitis comprised 43,600 rubles (6.5 percent).

The results which we obtained can be used in comparing the complex plans of rehabilitative measures on kolkhozes, development of measures to reduce temporary work capacity with regard to diseases of the nervous system, in dispensary work (specifically in formation of the dispensary group of

neurological patients with regard to social and hygienic factors affecting illness with temporary loss of work capacity) to determine the differentiated periods of treatment to prevent recurrence and in sanitation and educational work among agricultural workers.

BIBLIOGRAPHY

1. Garina, M. G., ZDRAVOOKHR. ROSSIYSK. FEDERATSII, No 8, 1970.
2. Polyakov, I. V., SOV. ZDRAVOOKHR., No 1, 1967.
3. Kuptsov, V. V., Loc. sit., No 9, 1975.
4. Kuptsov, V. V., Loc. sit., No 8, 1977.
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ALCOHOLISM

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ALCOHOLISM AND THE ENDOCRINE SYSTEM

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[Article by Cand Med Sci I. V. Kayusheva, School of Hospital Therapy No 2, Perm' Medical Institute]

[Text] Endocrine disorders are given a large role in the pathogenesis of alcoholism. Some researchers feel that such disorders may predetermine development of alcoholism and aggravate its course (1-3). The entire neuroendocrine system is subjected to toxic influences when alcohol enters the body. I. M. Sechenov had noted in his time that following absorption by the blood, alcohol acts mainly on the nerve cell, and that the diencephalon is especially vulnerable. Hypothalamic nuclei undergo functional and morphological alteration (4-8). The activity of enzymes responsible for breaking down alcohol decreases in cells of the hypothalamus, making them "defenseless" against the toxic action of alcohol (9). In this case the secretory activity of nuclei in the anterior hypothalamus decreases significantly (9). When the body is subjected to chronic alcoholic intoxication, functions of the cerebrovascular system are disturbed and universal angiopathy arises: The tone of the arteries drops and temporal hypotension can be revealed; venous flow is encumbered. The lumen of small vessels (arterioles, venules, capillaries) decreases due to proliferation and degeneration of endothelium, perivascular edema, and lymphoid infiltration about vessels (10-12). It is known that the vascular network is most highly developed in the hypothalamohypophyseal area: While there are about 2,000 capillaries per square millimeter of tissue in the cerebral cortex, there are 4,000 per square millimeter in the hypothalamus (13), in which case the capillaries of the latter normally exhibit very high permeability, owing to which neurohormone molecules penetrate into blood and into liquor from tissue (13). Changes in the autonomic nervous system accompanying chronic alcoholic intoxication arise sooner than do changes in functions of the cerebral cortex (14,15). This is why analysis of the autonomic nervous system should be recommended as one of the methods for the earliest possible diagnosis of alcoholic intoxication (15,16); moreover these changes do not disappear completely following either abstention from alcohol or treatment for alcoholism (17,18). Alcoholics develop breakdown of hypothalamic regulation of gas exchange, the intensity of which increases, creating a vicious circle because affected

vessels cannot supply enough oxygen to tissues (19). In addition dysfunction of the brain's catecholamine systems and reduction of their reactivity serves as a pathogenic mechanism of hypothalamic affliction (20), since the nervous transmitter substance norepinephrine undergoes activation, release, and breakdown. Release of norepinephrine in the hypothalamus, midbrain, and reticular formation can be explained by mental, autonomic, and motor arousal. A shortage of catecholamines subsequently develops in the brain, leading to mental and motor inhibition and sleepiness. The shortage of norepinephrine in the brain and the drop in tone of the brain's adrenergic structures not only cause mental and motor sluggishness but also promote arousal of a dependence upon alcohol, since repeated intake of alcohol temporarily intensifies release of norepinephrine and eliminates mental and autonomic discomfort (20). In the process of vital activities, nerve tissue in the chronic alcoholic begins to utilize alcohol instead of glucose as an energy source, and if the blood alcohol concentration drops, nervous tissue experiences hypoxia (21).

Persons suffering chronic alcoholism are stricken with a hypothalamic syndrome manifesting itself in autonomic-vascular and neuroendocrine forms (22). They might also be stricken by a neurotrophic syndrome, though trophic disorders cannot be related completely to diencephalic dysfunction, inasmuch as alcoholics as a rule suffer a thiamine and a general nutritional deficiency (18). Affliction of the hypothalamus leads to disturbance of the functions of all peripheral endocrine glands both transhypophyseally and parhypophyseally. Stage I alcoholism is typified by dysfunction of the hypophysis, while stages II and III are characterized by its hypofunction (1,18), in which case both the anterior and the posterior lobe of the hypophysis suffer. Release and deposition, in the neurohypophysis, of oxytocin and vasopressin are disturbed due to functional and morphological alteration of the supraoptic and paraventricular nuclei of the hypothalamus. Because alcohol is a very strong inhibitor of antidiuretic hormone, its entry into the body inevitably results in polyuria (23).

The function of peripheral endocrine glands is disturbed in the presence of alcoholism not only due to breakdown of hypothalamohypophyseal regulation but also because of the direct toxic influence alcohol has on tissues of the glands themselves (24,25). The hypothalamohypophyseoadrenal system experiences gross changes. ACTH production rises with acute alcoholic intoxication and in the early stages of chronic alcoholism; this means creation of excess glucocorticoids and adrenal sex steroids in the body (26-28). However, adrenocortical insufficiency develops very quickly in response to alcoholic intoxication (29-37). Toxic doses of alcohol elicit spot hemorrhaging and necrosis in the adrenal cortex (35), while with chronic alcoholism the weight of the adrenal glands decreases and they experience pronounced sclerotic and atrophic changes (36). Biochemical studies conducted by a number of authors provide direct evidence of the toxic influence of alcohol on the functional state of the adrenal cortex (37-41). Alcohol acts upon the enzymatic systems of the adrenal cortex responsible for energy production and hormone synthesis in these glands (9,32). Only a few authors fail to note abnormal deviations in the function

of this endocrine gland in the presence of alcoholism (42,43). The contradictory nature of the results can probably be explained by the fact that the figures presented were obtained in different periods of illness from different patients. V. I. Shishov (44) studied glucocorticoid and mineralocorticoid activity of the adrenal cortex in different periods of illness. He revealed that in a period of abstinence, following disappearance of sharply pronounced abstinence phenomena, and in a period of active antialcohol therapy, chronic alcoholism is accompanied by lower glucocorticoid and mineralocorticoid activity of the adrenal cortex. Adrenocortical insufficiency is especially pronounced in the alcoholism stage (45), in which the following clinical symptoms reveal themselves: hyperkalemia, hypochloremia, hemoconcentration, acidosis, gynoglycemia, tachycardia, tachypnea, and a therapeutic effect in response to administration of glucose and sodium chloride. It is only in the presence of delirium tremens that the glucocorticoid activity of the adrenal glands increases sharply, which can be explained by the considerable stressfulness of delirium.

The lucid intervals between fits of hard drinking promote preservation and some recovery of the functions of the adrenal cortex. The reserve glucocorticoid function of the adrenal glands persists to a greater extent in the presence of chronic alcoholism than does potential function (46).

As we know, alcohol is a severe stress factor. It disturbs homeostasis and tissue metabolism in the body. The adrenal glands help to compensate for these disorders and to restore disturbed homeostasis (4). Free corticosteroids circulating in the blood increase the activity of the liver's alcohol dehydrogenase and the catalytic activity of the blood, which accelerates oxidation of alcohol and consequently promotes faster reduction of its concentration in the blood (47). It has also been discovered that corticosteroids hinder penetration of alcohol into cells, changing the permeability of their membranes (41). Thus the functional activity of the adrenal glands has exceptionally important significance to both development of the alcohol syndrome and adaptation, while systematic intake of alcohol exhausts the functions of the adrenal cortex.

In the opinion of some authors (1,2,48) glucocorticoids must be included into alcoholism therapy. However, according to observations made by Zinyak (46) glucocorticoid treatment produces an insignificant effect, since metabolic disorders that can be explained by an insufficiency of the glucocorticoid function of the adrenal cortex are also associated in part with disturbances in the capability of tissues for utilizing corticosteroids.

Alcohol is one of the unfavorable factors influencing electrolyte metabolism (10,49), in which case its action on the electrolyte balance is mediated by the adrenal cortex (17,18,50). Subjecting the adrenal glands of alcoholics to morphological analysis, Alisiyevich (36) noted pronounced destructive processes mainly in the glomerular zone of the adrenal glands. A deficit of aldosterone arises--that is, the blood level of sodium and chlorine drops

while the potassium level rises (18). The greatest changes in ion equilibrium are observed in the period when patients are deprived of alcohol, when excretion of sodium with urine and saliva increases significantly and the erythrocytes experience a dramatic decline in potassium and growth in sodium (44). The mineralocorticoid function of the adrenal cortex may increase its activity in alcoholics following lengthy abstention from alcohol (51).

Pharmacological correction of electrolytic disorders may be a way to prevent severe psychoneurological disturbances, since disorders of electrolyte metabolism can be the cause of various psychoneural changes, to include psychoses and epileptic seizures (15,52). Such correction forestalls arising of epileptic seizures, alcoholic encephalopathy, and psychoses (53,54) all the more so because treatment of alcoholism with apomorphine and teturamin may aggravate electrolytic disorders and elicit even greater losses of chlorides and sodium (55).

Functions of the adrenal medulla also suffer in the presence of alcoholism. Alcohol acts as a specific provoking agent, causing catecholamines to be released from their deposition sites (the adrenal glands, the brain, chromaffin tissues), while growth in the catecholamine level is typical only of the early stages of alcoholism (25).

Disturbances of the hypothalamohypophyseothyroid system are typified by its hyperfunction in the initial stage of alcoholism and inhibition later on (1,18) in connection with hyposcretion of thyrotropic hormone and damage to thyroid parenchyma by alcohol--that is, hypothyroidism is pathogenetically primary and secondary. The symptoms of hyperthyroidism (fussiness, arousability, glazed eyes, tachycardia, sweating, and so on) manifest themselves especially clearly in the period of abstention from alcohol, and they alternate with the symptoms of hypothyroidism (sluggishness, bradycardia, edema, constipation, hyperkeratosis, and so on). Inhibition of thyroid function manifests itself most distinctly in the first stage of hangover and following consumption of massive doses of alcohol. Stable hypothyroidism promoting progress of atherosclerosis develops in stages II-III of alcoholism (56,57). Following lengthy abstention thyroid function normalizes and reverse development of the hangover syndrome proceeds in parallel with normalization of thyroid activity (12). Disturbance of thyroid function promotes the desire to abstain from alcohol (58).

The hypothalamohypophyseogerminal system suffers in the presence of alcoholism. The available literature is devoid of works describing research on the state of the gonadotropic function of the hypophysis in the presence of alcoholic intoxication, but the harmful influence the latter has on sex glands had been known for many decades. Disturbances of the sex function are noted in more than a third of male alcoholics (59), and they are manifested as premature ejaculation, weakening or complete suppression of erection, coupled with a persisting or a greater sex drive (60). The opinion exists that central nervous system disorders have dominant significance to the

pathogenesis of sexual disturbances (60). However, research on androgen and estrogen secretion showed that hormone deficiencies play a significant role in the genesis of alcoholic impotence. It has been established that testosterone accelerates alcohol breakdown in liver microsomes (61). The androgenic activity of the gonads of men suffering alcoholism for less than 10 years undergoes intensification; excretion of neutral 17-corticosterones exhibits a tendency for increase; estrogens, especially their biologically most active fraction--estradiol, are eliminated from the body intensively. Intensification of androgen biosynthesis by sex glands is accompanied by growth in tolerance of alcohol, and it serves as a protective mechanism (61). As the time of illness grows longer the physiological suitability of this mechanism wanes. Parenchyma in testicles injured by alcohol undergoes regeneration and atrophy, steroid production becomes disturbed, and in addition to androgens they begin to produce estrogens intensively, especially estradiol. As a result the longer the time of alcoholism, the more pronounced are the clinical symptoms of excessive estrogen production (loss of facial, chest, and pubic hair, true gynecomasty, anemia, and decrease of libido and potency) (64). During a period of temporary abstention from alcohol the sex function of patients wanes completely, but given appropriate treatment, it can be restored (62). Use of hormone preparations should be considered extremely cautiously in these cases (63). As a result of treatment and abstention from alcohol, estrogen biosynthesis declines while the androgen level in the patient's body does not change significantly (63). Disturbance of the generative function of the sex glands expresses itself as appearance of a large number of biologically deficient spermatozooids, which leads to infertility. At the same time histochemical research and electron microscopy have revealed gross disturbances in the structure of nuclei and protoplasm of spermatozooids that upon gross inspection appear morphologically normal; this may result in abnormal genetic development. A fetus produced from a biologically deficient spermatozoid would experience various disorders (64) going as far as chromosomal abnormalities (65).

Women suffering alcoholism also experience a disturbance in sex gland function, and they exhibit various disturbances of the menstrual-ovarian cycle (12). It is known that alcoholic narcomania develops much earlier in women and adolescents than in men (66,67) due to low testosterone production by the body--that is, because of the absence of natural physiological protection.

Atrophic processes develop in the insular apparatus and the pancreas experiences sclerosis and fatty infiltration in the presence of alcoholism. Glatt (68) found that hypoglycemia is typical of alcoholics even when they are sober--that is, their carbohydrate metabolism is disturbed. However, Zenevich (11) showed that the blood sugar level changes depending on the stage of illness and the condition of the patient at the moment of examination, and mainly on the patient's adrenergic level. A drop in the activity of the insular apparatus causes arising of latent sugar diabetes (69), which is promoted by vascular disorders accompanying alcoholism.

Alcoholic intoxication apparently elicits parathyroid dysfunction, since a rise in the concentration of inorganic phosphorus in blood has been

established in periods of abstinence and among patients suffering alcoholic psychoses. Following recovery or significant improvement, the concentration of inorganic phosphorus normalizes; this can be used as a laboratory sign of effective treatment (70). Liver damage alone cannot explain the observed demineralization of the skeleton, arisal of "fish" vertebrae, and development of platybrachyspondyly (decrease in height) in the presence of alcoholism (71).

Little research has been conducted on the influence of alcoholic intoxication on the thymus. Santisteban (72) demonstrated a direct dependence between the degree of involution of the thymus and the alcohol dose, believing that changes in thymus weight depend on adrenocortical function and not on the direct influence of alcohol on the thymus.

We can say in conclusion that changes experienced by the endocrine system in the presence of alcoholism require further study (73-75).

BIBLIOGRAPHY

1. Goldfarb, A. F., and Berman, S., QUART. J. STUD. ALCOHOL, Vol 10, 1949, p 415.
2. Smith, J. J., N.Y. J. MED., Vol 50, 1950, p 1704.
3. Lovell, H. W., and Tintera, J. W., GERIATRICS, Vol 6, 1951, p 1.
4. Savenko, V. A., ARKH. PAT., No 12, 1973, p 72.
5. Karlsson, L., Hirvonen, J., Saborinen, V., et al., ANN. MED. EXP., FEEN., Vol 45, 1967, p 72.
6. Mirazimov, T. M., in "Nauchnaya konf. sotrudnikov Tashkentsk. in-ta usovershenstvovaniya vrachey. 44-ya. Materialy" (Scientific Conference of Colleagues of the Tashkent Institute for the Advanced Training of Physicians. 44th. Proceedings), Tashkent, 1970, p 37.
7. Mirazimov, T. M., in "Nauchnaya konf. sotrudnikov Tashkentsk. in-ta usovershenstvovaniya vrachey. 44-ya. Materialy," Tashkent, 1970, p 36.
8. Mirazimov, T. M., Danilova, R. I., Islambekov, R. K., et al., in "Nauchno-prakticheskaya konf. respublikanskogo o-va patologoanatomov Uzbekistana. Materialy" (Scientific-Practical Conference of the Republic Society of Pathological Anatomists of the Uzbek SSR. Proceedings), Tashkent, 1969, p 102.
9. Savenko, V. A., Postnov, Yu. V., Polyakova, T. D., in "Nauchnaya konf. 4-go Glavnogo upravleniya pri Ministerstve zdravookhraneniya SSSR. Tezisy dokladov" (Scientific Conference of Main Administration No 4 of the USSR Ministry of Public Health. Report Abstracts), Moscow, 1972, p 78.

10. Segal, B. M., in "Voprosy psikhopatologii i psikhoterapii" (Problems of Psychopathology and Psychotherapy), Moscow, 1963, p 80.
11. Zenevich, G. V., in "Trudy Leningradsk. in-ta im. V. M. Bekhtereva" (Works of the Leningrad Institute imeni V. M. Bekhterev), Leningrad, 1967, p 5.
12. Pyatnitskaya, I. M. Karlov, V. A., and Elkonin, B. L., "Terapavticheskiye i nevrologicheskiye proyavleniya alkogolizma" (Therapeutic and Neurological Manifestations of Alcoholism), Moscow, 1977.
13. Grashchenkov, N. I., "Fiziologiya i patologiya gipotalamusa" (Hypothalamus Physiology and Pathology), Moscow, 1965.
14. Gilyarovskiy, V. A., "Staryye i novyye problemy v psikhiiatrii" (Old and New Problems in Psychiatry), Moscow, 1949.
15. Banskchikov, V. M., and Stolyarov, G. V., ZH. NEVROPATOL. I PSIKHIATR., Vol 58, 1958, p 1269.
16. Barabanchuk, V. G., VRACH. DELO, No 9, 1974, p 116.
17. Portnov, A. A., and Pyatnitskaya, I. N., "Klinika alkogolizma" (Clinical Treatment of Alcoholism), Leningrad, 1973.
18. Strel'chuk, I. V., "Ostraya i khronicheskaya intoksikatsiya alkogolem" (Acute and Chronic Intoxication by Alcohol), Moscow, 1973.
19. Zhukov, Yu. T., "Trudy Mosk. NII psikhiiatrii" (Works of the Moscow Scientific Research Institute of Psychiatry), Vol 45, 1966, p 306.
20. Anokhina, I. P., and Kogan, B. M., ZH. NEVROPATOL. I PSIKHIATR., No 12, 1975, p 1874.
21. Pyatnitskaya, I. N., ZH. NEVROPATOL. I PSIKHIATR., No 2, 1967, p 294.
22. Veyn, A. M., "Lektsii po patologii vegetativnoy nervnoy sistemy" (Lectures on Autonomic Nervous System Pathology), Moscow, 1971.
23. Munoz, C. C., MED. ESP., Vol 42, 1959, p 341.
24. Savina, Ye. A., "Trudy Leningradsk. in-ta usovershenstvovaniya vrachey" (Works of the Leningrad Institute for the Advanced Training of Physicians), No 49, 1966, p 43.
25. Ol'khovik, V. P., and Tabakman, M. B., in "Voprosy sudebnoy meditsiny" (Problems of Forensic Medicine), Moscow, 1968, p 413.

26. Solms, H., in Grule, G. (Editor), "Klinicheskaya psikhatriya" (Clinical Psychiatry), Moscow, 1967, p 192.
27. Shishov, V. I., FARMAKOL. I TOKSIKOL., No 4, 1972, p 481.
28. Gamburg, A. L., in "Alkogolizm" (Alcoholism), Moscow, 1959, p 193.
29. Kissin, B., Schenker, V., and Scherker, A. C., AM. J. MED. SCI., Vol 238, 1959, p 344.
30. Margraf, H. W., Moyer, C. A., Ashford, L. E., et al., J. SURG. RES., Vol 7, 1967, p 55.
31. Krengel, B. S., AFR. MED. J., Vol 42, 1968, p 83.
32. Cronholm, T., Sjoval, J., and Sjoval, K., STEROIDS, Vol 13, 1969, p 671.
33. Forsander, O. A., QUART. J. STUD. ALCOHOL, Vol 31, 1970, p 550.
34. Zurabyan, N. K., and Grinshpun, I. Sh., VRACH. DELO., No 8, 1963, p 146.
35. Antonov, I. M., in "Voprosy sudebnoy meditsiny i patologicheskoy fiziologii" (Problems of Forensic Medicine and Pathological Physiology), Arkhangel'sk, 1960, p 43.
36. Alisiyevich, V. I., SUD.-MED. EKSPERT., Vol 8, No 3, 1965, p 11.
37. Ellis, P. W., J. PHARMACOL. EXP. THER., Vol 153, 1966, p 121.
38. Kakihana, R., Noble, E. P., et al., NATURE, Vol 218, 1968, p 360.
39. Altland, P. D., Highman, S., Parker, M. G., et al., QUART. J. STUD. ALCOHOL, Vol 31A, 1970, p 729.
40. Fazekas, J. Gy., and Bertok, E., ENZYMOLOGIA, Vol 34, 1968, p 77.
41. Arbab-Zaden, A., MED. WELT. (Stuttg.), No 9, 1969, p 461.
42. Oltran, J. E., and Friedman, S., ARCH. NEUROL. PSYCHIAT., Vol 68, 1952, p 530.
43. Voegtlin, W. L., QUART. J. STUD. ALCOHOL., Vol 14, 1953, p 28.
44. Shishov, V. I., ZH. NEVROPATOL. I PSIKHIATR., No 2, 1973, p 235.
45. Shishov, V. I., and Pavlova, I. A., in "Somatologicheskiye issledovaniya pri psikhicheskikh zabolevaniyakh" (Somatological Analysis of Mental Diseases), Sverdlovsk, 1973, p 90.

46. Zinyak, M. Ya., in "Klinika, patogenez i lecheniye alkogolizma" (Clinical Pattern, Pathogenesis, and Treatment of Alcoholism), Kishinev, 1973, pp 83-101.
47. Fazekas, J. Gy., and Fazekas, A. T., ACTA MORPH. ACAD. SCI HUNG., Vol 16, 1968, p 341.
48. Kondrashina, A. S., in "Voprosy diagnostiki, lecheniya i profilaktiki alkogolizma" (Problems of Diagnosing, Treating, and Preventing Alcoholism), Chelyabinsk, 1966, p 105.
49. Nicholson, W. M., and Taylor, H. M., J. CLIN. INVEST., Vol 17, 1938, p 279.
50. Silkworth, W. D., and Texon, H., QUART. J. STUD. ALCOHOL., Vol 11, 1950, p 381.
51. Kissin, B., Schenker, V., and Schenker, A., QUART. J. STUD. ALCOHOL., Vol 20, 1959, p 480.
52. Tower, D. B., EPILEPSIA (Amst.), Vol 6, 1965, p 183.
53. Lecoq, R., and Vialle, M., ENCEPHALE, Vol 53, 1964, p 35.
54. Krystal, H., AM. J. PSYCHIAT., Vol 116, 1959, p 137.
55. Zenevich, G. V., and Libikh, S. S., "Lecheniye khronicheskogo alkogolizma" (Treatment of Chronic Alcoholism), Moscow, 1965.
56. Kononyachenko, V. A., "Alkogolizm i vnutrenniye bolezni" (Alcoholism and Internal Diseases), Moscow, 1956.
57. Gukasyan, A. G., "Khronicheskiy alkogolizm i sostoyaniye vnutrennikh organov" (Chronic Alcoholism and the Condition of Internal Organs), Moscow, 1968.
58. Segal, B. M., in "Voprosy psikhiiatrii" (Problems of Psychiatry), Moscow, Issue 3, 1959, p 437.
59. Zhukov, Yu. T., "Changes in Sex Gland Functions in the Clinical Pattern of Chronic Alcoholism," Candidate Dissertation Abstract, 1967.
60. Nokhurov, A., "Basic Clinical Variants of the Mutual Influence of Alcoholism and Sex Disorders in Men," Candidate Dissertation Abstract, Moscow, 1975.
61. Petrov, N. S., Belyayev, V. Ye., Novitskiy, V. A., et al., VRACH. DELO, No 4, 1977, p 100.

62. Nazaryan, S. S., ZH. EKSPER. I KLIN. MED., No 2, 1976, p 88.
63. Nokhurov, A., ZDRAVOOKHR. TURKMENIST., No 4, 1977, p 14.
64. Neshkov, N. S., VRACH. DELO, No 2, 1969, p 130.
65. Bochkov, N. P., "Genetika cheloveka, nasledstvennost' i patologiya" (Human Genetics, Heredity, and Pathology), Moscow, 1978.
66. Rakhal'skiy, Yu. Ye., in "Klinika, patogenez i lecheniye alkogolizma," Kishinev, 1973, p 38.
67. Kigel', D. G., et al., in "Trudy Permsk. med. in-ta" (Works of the Perm' Medical Institute), Vol 107, 1972, p 52.
68. Glatt, M. M., BRIT. J. ADDICT., Vol 53, 1957, p 109.
69. Mukhin, A. S., et al., KLIN. MED., No 6, 1977, p 72.
70. Bedakovskiy, V. F., Svirina, Ye. V., and Plyushchev, V. D., VRACH. DELO, No 5, 1973, pp 118-119.
71. Freydlin, L. M., and Ionkis, Ya. G., VESTN. RENTGENOL., No 3, 1977, p 63.
72. Santisteban, G. A., QUART. J. STUD. ALCOHOL., Vol 22, 1961, p 1.
73. Morozov, G. V., and Kachayev, A. K. (Editors), "Problemy alkogolizma" (The Problems of Alcoholism), Moscow, 1971.
74. Morozov, G. V., Strel'chuk, I. V., Al'tshuller, V. B., et al., "Sovremennyye metody lecheniya khronicheskogo alkogolizma. Nauch. obozr." (Modern Methods for Treating Chronic Alcoholism. A Scientific Review), Moscow, 1970.
75. Morozov, G. V., MED. GAZETA, No 45, 7 May 1978.
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EXPERIMENTAL STUDY OF EMOTIONAL REACTIONS OF MAN

Moscow EKSPERIMENTAL'NOYE ISSLEDOVANIYE EMOTSIONAL'NYKH REAKTSIY CHELOVEKA
in Russian 1979 signed to press 14 Feb 79 pp 2, 171

[Annotation and table of contents from the book by M. N. Rusalova,
Izdatel'stvo Nauka, 172 pages]

[Text] This monograph deals with the study of emotional reactions of adult, essentially healthy man. The author uses a wide assortment of methodological approaches, which make it possible to analytically simplify the phenomenon under study, and render the "variables" that affect it controllable and dependent on the experimenter.

The book contains a description of changes in many physiological processes characterizing a given emotional state (threshold of perception of sonic stimuli, galvanic skin reflex, electroencephalogram, electrocardiogram, electromyogram, etc.). The obtained data are discussed from the standpoint of information theory of emotions.

This book is intended for a wide circle of readers: psychologists, physiologists and physicians.

There are 60 figures, 6 tables and 11-page bibliography.

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BEHAVIORAL SCIENCES

A PORTABLE STAND FOR ASSESSING THE DYNAMICS OF A WORKING INDIVIDUAL'S FUNCTIONAL STATE

Moscow TEKHNICHESKAYA ESTETIKA in Russian No 7, 1979 pp 24-26

[Article by Cand Psych Sci A. B. Leonova, MGU, and Cand Psych Sci V. G. Romanyuta, VNIITE]

[Text] Solution of the practical problems associated with assessing human functional state requires creation of adequate testing methods and development of reliable and convenient technical testing resources. Among the numerous methods presently existing, researchers are being attracted more and more by psychological assessment methods (1), which make use of real conditions and have a number of advantages over the traditionally employed physiological diagnostic methods.

Diagnosis of functional states is performed most often in psychological practice on the basis of the success with which a particular form of activity is completed. In this case we examine the dynamics of the quantity, quality, and speed of the work, and changes in corresponding psychological functions at the basis of the work. Attempts at limiting assessment of a working individual's functional state to analysis of labor productivity dynamics are found to be not very effective in most cases. This is why short test trials providing information on the state of different mental processes during performance of a work assignment are the principal psychological diagnostic resource. In this case the problem of assessing functional state appears as a typical psychometric problem: Changes in psychological characteristics under analysis, occurring under the influence of certain causes (loads in our case), must be described and quantitatively assessed (6).

One of the principal shortcomings of traditional psychometric testing methods is the fact that they can be used to assess only the results of observed phenomena, and as a rule they do not permit any sort of analysis of the causes (or psychological mechanisms) behind the changes occurring. At the same time it is well known that when an individual's functional state changes, the structure of the activity he performs and the mental processes supporting this activity are the first to change (5). Therefore if testing

is to be effective, a system of psychometric tests determining the state of all links in the operational structure of the form of mental activity under examination must be employed (2).

Such a system of functional tests was developed in a series of experiments with the purpose of studying the microstructure of visual information transformation; the system's capability for testing changes in an individual's functional state was demonstrated (2,3). A significant merit of this system of tests is that it is automatically run with the help of a computer. Use of a computer during the experiment significantly broadens the possibilities for using diagnostic procedures. Full automation of the principal stages of the experiment, the vastness of the range of experimental conditions employed (in terms of the qualitative diversity and unlimited number of stimuli, broad variation of information presentation time, and so on), and the possibilities afforded for utilizing optimum strategies in the research and developing adaptive programs significantly improved the quality of psychological testing. Moreover use of a computer makes it possible to make assessments and obtain data during the experiment in a real time scale, which means that information can be obtained quickly on the dynamics of an individual's functional state.

However, use of general-purpose computers in practical research on human functional state is not always possible. The principal obstacles in this case are the high cost of the computer itself (or of renting computer time), the low use factor, the large amount of space and service personnel required, and territorial incompatibility with the place where the research is to be conducted. These shortcomings express themselves especially clearly when a large number of highly specialized tasks must be completed, in which case spending the great amount of computer time required for just programming alone is found to be inefficient. Thus it would be more suitable to use specialized apparatus.

Working jointly with specialists of the MGU (Moscow State University), the VITE (All-Union Scientific Research Institute of Technical Esthetics) has developed and tested, in the laboratory, an experimental stand that has small overall dimensions and low weight, is convenient to use, transportable, and suited to use at an operator's workplace. Its purpose is to assess human functional state in accordance with several procedures stored in the described test system's short-term memory. The stand's specifications are as follows: number of two-digit numbers presented at a time--4; exposure time--10-50 msec; stimulus spacing--50-500 msec; display--IV-6; weight--1.5 kg; power--220 w; distance between experimenter and subject--3 meters.

Figure 1 shows a structural diagram of the stand. The instrument's principle of operation is based on the use of a microprocessor within the composition of an Elektronika miniature calculator. During the tests the calculator's microprocessor is used as a working memory, which stores a given sequence of numbers to be presented to the subject. The number sequence is set by the experimenter before each test by the means of the calculator keys, and it is

stored in the calculator until new information is introduced. After the experiments the necessary computations can be made on the calculator.

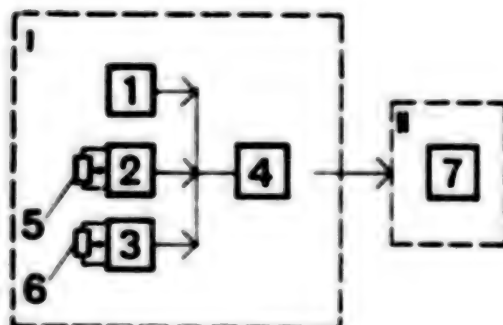


Figure 1. Block Diagram of Experimental Stand: I--Experimenter's console; II--subject's console; 1--microcalculator; 2--presentation time clock; 3--stimulus spacing clock; 4--switching device; 5,6--clock adjustment fixtures; 7--subject's light signal panel.

The experimental stand consists of two blocks--the experimenter's console (I) and the subject's console (II). Following the plan of the experiment, the experimenter composes the required information on the panel of the calculator 1, and the correctness of this information is checked on the light signal panel. Controls 5 and 6 on the instrument panel are used to set the presentation time (the presentation time clock 2) and the spacing between stimuli (clock 3). When the "Start" button is pressed signals are transmitted from the calculator and the clocks to switching device 4, which begins transmitting the composed information (two numbers at a time) at the necessary temporal spacing to light signal panel 7 located on the subject's console.

The image created by vacuum-type electric luminescent display elements (light signal panel 7) can be seen well within a specially blackened tube, which makes it possible to use the equipment in bright light. If it becomes necessary to increase the length of the succession of stimuli presented, a calculator with a larger number of digits can be employed.

One of the goals of experiments aimed at studying the dynamics of human functional state during learning activity was to test the portable stand described above.

The experiments were performed during foreign language lessons using the "suggestopedic" technique (4). This technique foresees mastery of the

skills of communicating in a certain foreign language within an extremely short time (within 1.5 months), which means that the student experiences a rather intense load. The principles of psychotherapy and social psychology were utilized to develop the teaching technique: Special conditions are created for the students, such that they remain relaxed and happy and the usual psychological barriers are surmounted, and much attention is devoted to forming adequate interpersonal relationships. Thus in the opinion of the authors of the suggestopedic method the feeling of tiredness usually accompanying such intense activity is absent from the training. It may be hypothesized that specific features of the type of activity being studied may have an effect on the dynamics of the individual's functional state. In particular significant worsening of working ability would be observed only as subjects become habituated to a training situation full of surprises, and as the negative effect of loads of greater intensity accumulates. This hypothesis is confirmed by published data as well as by an analysis of subjective assessments of tiring obtained during training sessions.

The experiment was conducted with subjects from 28 to 45 years old studying French (group I) and German (group II) by the suggestopedic technique. The subjects consisted mainly of instructors and scientists of the MGU. In all, 15 persons took part in the experiment. Psychometric testing was performed throughout the entire training cycle of 6 weeks.

We used the full recall method as the psychometric test in our work. This choice stemmed from the highly general nature of this method and its diagnostic suitability, as well as the maximum simplicity of performing this method with the portable stand proposed here. This method is as follows. The subject is shown a sequence of numbers, after which he must fully recall the entire series in the same order in which it was presented. The recall results depend on the effectiveness with which the subject performs his operations of repetition and recall, as well as on the volume of information stored in the individual's initial memory.

Subjects were shown sequences consisting of three two-digit numbers. Presentation time of one two-digit number was 20 msec, and the spacing between stimuli in the main series of the trials was constant--18 msec. Before the main trials were started, each subject underwent a series of training trials in which the stimulus spacing was gradually decreased from 150 msec to 180 msec.

Each testing session consisted of 20 trials--individual presentations of number sequences followed by verbal answers from the subject. The sequences of two-digit numbers were composed with the help of random number tables with the conditions that a number would not be encountered more than once in any particular test and that particular number sequences would not repeat themselves in a single trial.

In the first week of the lessons each subject underwent three or four trials with the full recall method. In this stage the subject experienced initial

adaptation to the particular features of the training process, and each lesson ended with a psychometric test. In subsequent weeks each subject participated in the experiment one or two times a week.

Experiments were performed each day with four or five students. The subjects arrived in the classroom 10 minutes before the lesson and performed a short-term memorization test. Repeat testing was performed immediately after the lesson, 4 hours later. The dynamics of subject functional state were tested by means of one of the subjective methods for assessing tiring--the (SAN) task; however, analysis of this category of data is not the objective of the present article.

The following data were recorded on the data sheets for the full recall method before and after the lesson:

The total number of errors made by the subject in 20 trials, before and after the lesson;

the number of omitted numbers in each of the same trials (omission error);

the number of incorrectly recalled numbers in the same trials (incorrect responses);

the quantity of numbers recalled in incorrect sequence within a single trial of these same trials (repositioning error).

Wilcoxon's test and the χ^2 statistical test were used to determine the significance of tendencies towards improvement or worsening in the psychometric test. The results were analyzed separately each week and in relation to the entire experiment as a whole.

Analysis of the results for the experiment as a whole (the data of all subjects in all trials were generalized) did not reveal a significant tendency toward worsening of full recall toward the end of the training period. However, when we excluded from the data those results which had been obtained in the first week of training, when the dynamics of test completion effectiveness depended in many ways on the training level of the subjects and the unusual nature of the study situation, we observed a significant increase in the number of errors made in tests taken at the end of the lesson (χ^2 test, $p=0.55$).

Qualitative analysis of errors made by the subjects in tests before and after each lesson (omission errors, repositioning errors, incorrect answers) showed that on the whole there are no definite tendencies toward preferential arising of errors of a particular type in response to a load in the experiment as a whole. An exception could be found only with experimental group I, which underwent its lessons in the morning. A larger number of omission errors was typical of these subjects in tests taken before lessons, while worsening of recall at the end of each lesson occurred due to a significant

increase in the number of errors of the "incorrect answers" type (Wilcoxon's test, $p \leq 0.05$). The explanation for this fact may be that at the beginning of the work day, the attention of the students had not risen to its optimum level yet, and an intense load influences mainly the characteristics of short-term memorization.

Highly interesting data were obtained in an analysis of the dynamics of test completion characteristics depending on duration of the training. To provide a visual idea of the overall pattern of changes, a histogram of the total number of errors made by subjects in the experiments before and after each lesson during each week was plotted. In this case we used data only from those subjects who participated in the experiment regularly (Figure 2).

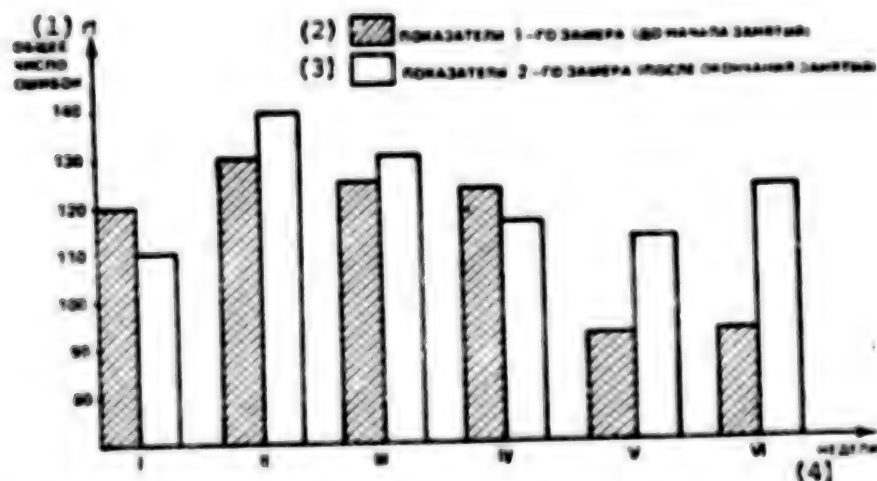


Figure 2. Histogram of the Number of Errors Made By Subjects

Key:

1. Total number of errors
2. First measurement (before lessons)
3. Second measurement (after lessons)
4. Weeks

A number of interesting observations can be made in this regard. The total number of wrong answers given by the subjects gradually decreases toward the end of the training cycle, stabilizing by the 5th and 6th weeks of training (Wilcoxon's test, $p \leq 0.05$). In this case the difference between the number of errors made in experiments before lessons and the number made after lessons grows. A significant worsening of results at the end of lessons can be noted in the 5th and 6th weeks (χ^2 test, $p \leq 0.05$). These data suggest arising of chronic effects caused by cumulative tiring in the 6-week training cycle, arising of which facilitates gradual adaptation by the students to an emotionally saturated training situation to which they are not accustomed.

Data indicating existence of a stable relationship between subjective assessments of change in functional state and the psychometric characteristics were found to be interesting. When the subjects exhibited pronounced deterioration of the way they felt (as defined by the appropriate categories of signs in the (SAN) tests) existence of a significant tendency toward decline of the characteristics of full recall was discovered (Wilcoxon's test, $p \leq 0.05$), while when the way the subjects felt improved significantly, a similar change occurs in the short-term memorization test (Wilcoxon's test, $p \leq 0.01$). In other words assessments of functional states obtained by qualitatively different techniques exhibit the same direction.

On the whole the experimental data indicate existence of certain tendencies in change of the functional state of subjects performing the intensive activity of mastering a foreign language. However, the unique features of these dynamics cannot be explained by preferential influence of the factors of acute and chronic tiring. The unique features of the training method itself caused formation of an entirely unique functional state in the subjects for which the aftermath of experiencing intense loads expressed itself in inobvious form. At the same time research on well organized activity has demonstrated the diagnostic suitability of the methods employed.

Thus experimental research employing psychometric testing revealed the unique features of the dynamics of functional state experienced by students in a specific training situation, and it provided material with which to describe the causes of these dynamics. Sensible organization of the experiment based on the portable stand described here was found to be highly significant in this regard. The main advantages of the approach taken here include the possibilities for testing right during the training process and in natural training conditions, and the possibility for performing several test trials, owing to which the maximum number of subjects could be tested. Another advantage is that technical problems do not arise during the testing time. Our experimental stand creates a large number of advantages for experimenters as well: It makes giving the test simple, it affords a possibility for monitoring the course of the experiment and correcting it, and it permits direct contact with the subject.

Perhaps the research results may have been more complete, had the testing been performed with a large number of short-term memory tasks, as is suggested in the previously proposed system of functional tests, and had the stimulus material been more adequate to the content of the activity, having in mind alphabetic stimuli. However, before such research could be conducted, we would need to make certain improvements in the proposed experimental stand. That is the goal of our continuing work. Our objective in the present article was to use concrete experimental research as an example with which to demonstrate the suitability and possibility of using specialized portable devices in psychometric testing.

BIBLIOGRAPHY

1. Zinchenko, V. P., and Leonova, A. B., "Metody otsenki funktsional'nykh sostoyaniy cheloveka. Seriya: Itogi nauki. Fiziologiya cheloveka i zhivotnykh" (Methods for Evaluating Human Functional States. Series: Scientific Results. Human and Animal Physiology), Vol 21, Moscow, Izd-vo VINITI, 1978.
2. Zinchenko, V. P., Leonova, A. B., and Strelkov, Yu. K., "Psikhometrika utomleniya" (The Psychometrics of Tiring), Izd-vo MGU, 1977.
3. Leonova, A. B., "Automated Assessment of Functional States," *TEKHINICHESKAYA ESTETIKA*, No 10, 1974.
4. Lozanov, G., "Suggestopedics in Foreign Language Study," in "Metody intensivnogo obucheniya isnostrannym yazykam" (Methods of Intensive Foreign Language Study), 1st Edition, Moscow, 1973.
5. Medvedev, V. I., "Operator Functional States," in "Ergonomika. Printsipy i rekomendatsii" (Ergonomics. Principles and Recommendations), 1st Edition, Moscow, VNIITE, 1970.
6. Anastasi, A., "Psychological Testing," 4th Edition, New York-London, Macmillan, 1967.
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BLOOD SERUM ENZYMES AND CONTENT OF FREE AMINOACIDS IN INDIVIDUALS IN
CONTACT WITH FLUORINE COMPOUNDS

Kiev VRACHEBNOYE DELO in Russian No 6, 1979 pp 103-105

[Article by M. M. Potyazhenko, Department of Faculty Treatment of the
Therapy Faculty, Poltava Medical Stomatological Institute]

[Text] The introduction into clinical practise of methods of study of
enzymes and aminoacids is making it possible to make decisions on the
metabolic changes occurring at the cellular and molecular level and is
creating the possibility of clarifying the pathologic shifts which have
not yet found expression in the clinic (E. G. Larskiy, 1966; I. M. Markelov,
T. Ye. Gembitskaya, 1971; P. A. Bakalyan, 1971; A. A. Pokrovskiy, 1974,
and others).

Lactatedehydrogenase (LDH) and creatinephosphokinase (CPK) are enzymes which
play a great role in processes of energy formation. Work by different
authors (N. I. Luk'yanova, et al., 1967; Zh. N. Netakhata, S. N. Lyapun,
1973, and others) has found that aminoacids are one of the basic sources
of energy in the myocardium since, in the process of their conversion, com-
pounds like ATP are also formed in large amounts.

Over a three year period, systematic study has been made of the state of
health of workers at a plant for chemical machine construction. In order
to clarify the status of activity of some enzymes which participate in
energy formation processes and of the content of free aminoacids, under the
influence of fluorides on the human body, we have examined 38 workers who
come into contact with fluorine compounds in the process of production of
enamel (males—30, females—8) and 25 people who were a control group. Age
of the majority of the workers was up to 30, time worked on the enterprise,
from one to three years (two years on the average).

Study of the sanitary hygiene conditions of the enamel preparation shop,
which we carried on for two years, indicated that content of fluorine com-
pounds in the air of the production sites almost continually exceeds the
maximum permissible levels.

The examined contingent displayed an increase in concentration of fluorine

in the blood and its elimination in the urine after the work shift.

Most frequently, the examinees presented the following complaints: general weakness (25 persons), rapid tiring (16), sleepiness at the end of the shift (20), pains in the bones of the extremities (13), headache (10). Auscultation of 11 persons showed weakness of the first tone on the upper heart, seven, an insignificantly-pronounced systolic noise. All these symptoms can indicate damage of the nervous system and cardiovascular disorders which appear in workers who contact fluorine compounds.

Activity of LDH isoenzymes in the blood serum was assayed by a micromethod--modified by us together with A. M. Dudchenko--based on a system of ultra-micro-rapid analysis worked out in the laboratory of A. A. Pokrovskiy (1962). The basis of the assay of general activity is derived from a method of V. S. Asatini (1969). To differentiate the isoenzyme spectrum of LDH, we used the heat inactivation principle (F. I. Komarov, et al., 1976); recording the activity of the isoenzymes is based on spectrophotometric evaluation of the intensity of oxidation of a reduced form of nicotinamideadeninedinucleotide (NADH) with reduction of the pyruvate into the lactate.

CPK was studied by the method of L. P. Grinio and A. V. Konsistorum (1965). Content of free aminoacids in the blood serum was measured chromatographically in an automatic analyzer of aminoacids type Nd-1200E,

To establish the normal values, determination was made of the enzymes studied and of the free aminoacids in the 25 practically healthy people of both sexes who did not come in contact with the chemical substances.

Indices of the studied enzymes in the workers who were in contact with fluorine compounds is presented in the Table.

Analysis of the data obtained indicated that in those in contact with fluorine compounds there are changes in the spectrum of LDH isoenzymes. Thus, the workers manifested a reliable increase of the fifth fraction of LDH isoenzyme and a tendency to an increase in total LDH activity.

Creatinekinase activity of the blood serum in the workers as compared with that in the control group did not substantially change.

Comparison of results of content of free aminoacids in the blood serum of workers who came in contact with fluorine compounds and in the control group showed a decrease in the sum of all aminoacids (from 114.8 to 100.1 μ moles, $P > 0.5$), a decrease in workers of the quantitative ratios among the individual aminoacids.

Especially pronounced was the decrease in content of the essential amino-acid phenylalanine (from 4.81 to 3.11 μ moles) and of the non-essential alanine (from 21.5 to 9.15 μ moles, $P < 0.01$).

TABLE

Index	Control group	Persons in contact with fluorides	P
Lactate dehydrogenase (LDH) (units of optical density)	0.99 ± 0.07	1.15 ± 0.09	> 0.05
LDH ₂₋₄ (units of optical density)	0.70 ± 0.05	0.75 ± 0.05	> 0.05
LDH ₅ (units of optical density)	0.29 ± 0.02	0.40 ± 0.02	< 0.05
Creatinephosphokinase (CPK) (mg/l)	1.35 ± 0.14	1.32 ± 0.08	> 0.1

The changes in aminoacid content in those coming in contact with fluorine compounds can be explained by a functional insufficiency of liver cells under the influence of the fluorine (N. A. Bogdanov, Yu. Yu. Bonitenko, 1973).

Therefore, results of our studies indicated that in workers who come into contact with fluorides, there are seen changes in the enzyme spectrum of LDH (substantial rise in LDH₅ isoenzyme and mean-arithmetical rise in total LDH activity) which can testify to an increase in permeability of the cellular membranes of the myocardium as a consequence of disturbance of energy exchange under the influence of fluorides.

The disproportional character of the observed changes in the aminoacid composition, expressed, mostly, in a decrease of content of free aminoacids in the blood serum of workers subjected to the fluoride intoxication, can lead to disturbance of the system of proteins, biologically active substances and energy phosphate compounds.

BIBLIOGRAPHY

1. Asatiani, V. S., in the book, Enzyme Methods of Analysis (in Russian). Nauka, 1969, p. 588
2. Bogdanov, N. A., and Bonitenko, Yu. Yu., in the book, Military Medical Aspects of Modern Gastroenterology (in Russian). Leningrad, 1973, p. 115
3. Bakalyan, P. A., Author abstract of a doctorate thesis (in Russian). Yerevan, 1971
4. Grinio, L. P. and Konsistorum, A. V., VOPR. MED. KHIMII, No 1, 1964, p. 70
5. Komarov, F. I., et al., in the book, Biochemical Methods in the Clinic (in Russian). Leningrad, Meditsina, 1976, p. 36
6. LarSKIY, E. G., Materials of the Sixth All-Union Conference of Physicians-Laboratory Scientists (in Russian). Moscow, 1966, p. 5
7. Luk'yanova, N. I., et al., VRACH. DELO, No 5, 1967, p. 57
8. Markelov, I. M. and Gembitskaya, T. Ye., TER. ARKH., Vol 43, No 9, 1971, p. 8
9. Netakhata, Zh. N. and Lyapun, S. N., SOV. MED., No 3, 1973, p. 38
10. Pokrovskiy, A. A., in the book, Chemical Bases of Processes of Vital Activity (in Russian). Edited by V. N. Orekhovich, 1962
11. —————, Abstracts of the Seventeenth All-Union Congress of Therapeutic physicians (in Russian), Moscow, Vol 1, 1974, p. 71

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EFFECT OF A LOW-INTENSITY ELECTROMAGNETIC FIELD IN THE SUPER HIGH FREQUENCY RANGE ON THE COURSE OF ALLERGIC REACTIONS OF THE DELAYED TYPE

Kiev VRACHEBNOYE DELO in Russian No 6, 1979 pp 101-103

[Article by Candidate of Medical Sciences G. I. Vinogradov and Ye. I. Vinarskaya, Laboratory of Biological Hygiene Studies, Kiev Scientific Research Institute of General and Communal Hygiene imeni A. N. Marzeyev]

[Text] Study of allergic reactions which are associated with the action of super high frequency (SVCh) energy—one of the common physical factors of the environment—has been acquiring important significance for evaluation of immunological response of the body. It has been found that intensities of SVCh-radiation above 10 mw/cm^2 prevent or weaken the development of anaphylactic shock in animals to which a resolving dose of antigen has been administered immediately after the irradiation (B. A. Chukhlov, 1966).

Studies carried out by us in preceding years (G. I. Vinogradov and Yu. D. Dumanskiy, 1974), have shown that irradiation by an SVCh field at an energy flow density (PPE) of 50 mcw/cm^2 leads to depression of antibody genesis and to weakening of anaphylactic shock. This occurs when the radiation precedes administration of the antigen (equine serum), and also with radiation of an already sensitized body.

The data referred to relate to the effect of an electromagnetic field in the microwave range on the course of allergic reactions of the immediate type. In addition, there are, in the literature, almost no reports of study of the action of microwaves on the hypersensitivity of the delayed type.

The premise to formulation of our studies was the known view that contact allergy to dinitrochlorobenzene (DNCB) permits the assessment of the capacity of the body to develop a reaction of delayed hypersensitivity and, also, the determination of functional activity of the T-system of immunity. In order to determine the influence of electromagnetic energy of the SVCh range on the condition of the T-system of immunity, we compared, in the experiments carried out, the data on the morphological characteristics of T-lymphocytes based on reaction of blast transformation under the influence of a nonspecific mitogen, phytohemagglutinin (PHA) and their functional

activity in a model of allergic contact dermatitis with dinitrochlorobenzene.

The experiment was run on 78 guinea pigs, average weight 200-250 g. According to experimental conditions, all the animals were divided into four groups. The first group (15) was the intact control. The second group was guinea pigs irradiated with SVCh energy of 50 mcw/cm² for ten days, seven hours per day. The third was guinea pigs irradiated under the same conditions for 20 days; the fourth was guinea pigs irradiated 30 days. There were 21 animals in each group [2nd to 4th]. Radiation was carried out in sound-absorption chambers using the "Luch-2" apparatus with systematic control over the energy flow density.

Setting up the reaction of the blast-transformation of lymphocytes and reproduction of the contact dermatitis with DNCB was carried out right after completion of irradiation and then after one and two months. At each stage, seven guinea pigs were taken for the experiment.

In correspondence with the procedure (of A. S. Raben, et al., 1970), experimental, allergic contact dermatitis was reproduced by daily application (in the course of 7 days) of a 1% solution of DNCB in acetone. The resolving application (skin test) of one drop of DNCB we set after 24 hours. Intensity of the developing sensitization was estimated visually according to the expressivity of the inflammatory reaction of the skin at the site of the skin test, based on a five-point system: 0--absence of a reaction; 1--weak erythema; 2--clear erythema; 3--ditto, plus consolidation; 4--severe erythema with signs of hemorrhage, with pronounced infiltrations; 5--serous-hemorrhagic scab with ulceration.

Analysis of the data obtained on reproduction of contact dermatitis with dinitrochlorobenzene indicated that radiation with microwaves of 50 mcw/cm² intensity leads to sharp depression of reaction of the delayed type. Thus, in the control, non-irradiated animals, the expressivity of the dermatitis was practically unchanged in the course of the entire experiment (3.0 ± 0.26 to 3.3 ± 0.24). Radiation with SVCh-energy for 10 days led to reliable lowering of the intensity of the dermatitis. Point evaluation of the reaction was 0.75 ± 0.14 ; hereby in three guinea pigs, the reaction was completely absent. Still more pronounced depression of dermatitis took place where the animals were irradiated 20 and 30 days.

In the first case, the reaction to a resolving administration of the allergen occurred only in two guinea pigs (2 and 1 point), in the second case, in three (1 point). Hence, the depressing action of the SVCh field on the course of the allergic contact dermatitis becomes evident. This depression grew with increase in the duration of the action. Subsequently, a tendency was seen to recovery of the function of the immune system and the depressing action of irradiation gradually decreases, which leads to more intense manifestation of contact hypersensitivity. At the end of the second month of observation, the expressivity of the skin reactions after ten-day irradiation with the SVCh-field did not differ reliably from that in the controls.

Intensity of allergic dermatitis in this case amounts to 3.3 ± 0.19 points. After a two-month recovery period from the 20-day irradiation, the expressivity of the dermatitis also does not differ from that in the control; however the action of the super high energy in the course of 30 days evokes a deeper injury of the mechanisms of immune defense and the capacity to reproduce contact dermatitis with DNCB remains below the norm (the control).

These observations to a definite degree correlate with the functional activity of T-lymphocytes responsible for manifestation of cellular (delayed) hypersensitivity.

In the control animals, stimulation of lymphocytes of the peripheral blood into blasts under the influence of PHA is $35.4 \pm 3.8\%$ to $31.7 \pm 2.4\%$. In the experimental animals which were subjected to irradiation by SVCh-energy at an energy flow density of 50 mcw/cm^2 , the percent of blast formation is reliably decreased. Thus, at the end of the irradiation, the percent of blasts amounts to 22.1 ± 2.7 to 18.6 ± 2.3 . Judging by the amount of small lymphocytes transforming into blast cells under the influence of phytohemagglutinin, the functional activity of the T-system of immunity is substantially depressed under the action of SVCh-energy. The degree of this depression after completion of irradiation does not depend on the energy flow density; however, at the end of the second month of the period of the after effect, the percent of stimulated lymphocytes of the peripheral blood in guinea pigs irradiated for 20 and 30 days does not reach the initial level.

Comparing the data obtained, we can conclude that electromagnetic energy of the super high frequency range, with PPE of 50 mcw/cm^2 , evokes a depression of the system of cellular immunity. This is manifested as a lowering of the level of blast transformation of lymphocytes and as an inhibition of allergic contact dermatitis with dinitrochlorobenzene. Hence, microwave radiation at this level of action leads to appearance of an immunodeficient state in the thymus-dependent population of lymphocytes. Simultaneously with this, there occurs also a depression of the B-system of immunity, in which there is a disturbance of processing of antibodies and an inhibition of allergic reactions of the immediate type which was shown by us in previously performed studies (G. I. Vinogradov and Yu. D. Dumanskiy, 1974).

It is especially important that precisely the immunodepressive state can appear, in correspondence with modern concepts (R. V. Petrov, 1976; Fudenberg, 1971), as the cause of the development of autoimmune processes which arise under the action of an electromagnetic field in the super high frequency range (G. I. Vinogradov and Yu. D. Dumanskiy, 1975).

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SECOND ALL-UNION CONFERENCE ON BIRD MIGRATION

Moscow ZOOLOGICHESKIY ZHURNAL in Russian No 6, 1979 pp 943-944

[Article by V. M. Gavrilov and A. P. Gistsov]

[Text] This conference was held in Alma-Ata on 8-11 August 1978. More than 200 people from 13 Union republics, 52 cities of the USSR, foreign scientists from GDR, Hungary and Poland participated in its work.

The conference summed up the results of studies dealing with bird migration, which were conducted by USSR ornithologists in the 3 years since the first conference (Moscow, 1975). The main directions of investigation of bird migration and orientation were discussed in the papers of V. D. Il'ichev, "Theoretical and Applied Aspects of Studying Spatial Orientation" and Kh. A. Mikhel'son, "Results and Prospects of Studying Orientation of Birds in Round Cages." Medical aspects of migration were discussed in the papers of Ye. V. Gvozdev, M. D. Soin and D. K. L'vov. The landform-ecological patterns of migration in some regions and spatial structure of populations during migrations and hibernations were reflected in a paper by a team of Central Asian and Kazakhstan ornithologists, and the papers of E. V. Kumari and A. V. Mikheyev. V. R. Dol'nik dwelled in his paper on analysis of the physiological causes of bird migration, ranging from external stimuli for migration to physiological and biochemical bases; he discussed the origin of the migratory state and routes of its evolution, as well as link to other seasonal phenomena. Much new, concrete material characterizing nocturnal migration of birds was submitted in the paper of K. V. Bol'shakov, entitled "Investigation of Nocturnal Migration of Birds." The author's conception alters appreciably the traditional conceptions of nocturnal migrations. The biological bases of avoidance of collisions between birds and aircraft were reflected in the papers of M. A. Voinstvenskiy et al., V. E. Yakobi and V. A. Nikitin. Aspects of bird protection during the migration period and prospects of international collaboration were discussed at the plenary sessions. Foreign participants delivered two papers: "Hunting for Aquatic Birds in GDR and Effect Thereof on Migratory Species," by A. Zifke (GDR) and "Some Problems of International Collaboration and Standardization of Methods of Studying Bird Migration," by P. Busse (Poland).

In addition to the plenary sessions, there were seven symposiums: "Ecology and Protection of Migratory Birds," "Regional Aspects of Migration," "Medical and Parasitological Aspects of Migration," "Aviation Aspects of Migration," "Ecological and Physiological Aspects of Migration," "Migration of Different Bird Species and Groups" and "Methodological Problems of Investigation of Migrations." About 100 papers and reports were delivered at these symposiums.

During the conference, there was discussion of the matter of preparing a collective monograph entitled "Migration of Birds of Eastern Europe and Northern Asia."

The conference showed that the systematic study of bird migration, which was begun several years ago, underwent maximum development since the First All-Union Conference. There has been considerable expansion of research on applied ornithology; substantial progress has been made in the study of the role of birds in dissemination of endemic sites of arboviruses. At the same time, there was negligible increase in number of ornithologists who are proficient in experimental techniques for the study of physiological bases of the migratory state of birds. The participants at the conference noted with satisfaction that there was expansion of work on identifying birds with rings in our country and, particularly, in Kazakhstan. At the same time, it was noted that, in spite of the advances in the study of bird migration and orientation, the technical support for the research is minimal in a number of cases (little use is made of radar, night-vision instruments and radio tracking, range finders, altimeters, etc.); the quality and assortment of rings and labels used do not always meet current requirements; regular publication of information bulletins about returned rings has not been organized.

During the conference, there was a meeting of the coordinating council for problems of migration and orientation of birds of the USSR Academy of Sciences and its Central Asian regional commission, as well as the Ornithological Committee of the USSR. At the final plenary session, V. D. Il'ichev delivered a report on the activities of the coordinating council, while V. M. Galushin discussed the work of the Ornithological Committee.

Two collections of material, containing about 320 reports, were published just before the start of the conference.

The resolution adopted by the conference stressed the need to expand and to go deeper into the following main directions: ecological research with the use of modern methods directed toward forecasting and controlling the migratory process; investigation of the role of birds in circulation of pathogens of infectious and invasive diseases of man and animals; development of ecological bases of aviation ornithology; ecological and physiological bases of the migratory state and behavior of birds.

The conference was well-organized; the meetings were held in comfortable and spacious auditoriums, and this contributed significantly to its

good work. It was decided to convene the Third All-Union Conference on Bird Migration in 1981, in the city of Kishinev, together with the Eighth All-Union Ornithological Conference.
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THE STATUS AND OUTLOOK FOR PROPAGATING ACCLIMATIZANTS IN THE ARAL SEA

Kiev GIDROBIOLOGICHESKIY ZHURNAL in Russian No 3, 1979

[Article by Ye. S. Proskurina, Aral Division of the KazNIIRKh [Kazakh Scientific Research Institute of Fisheries]]

[Text] In order to enrich the fauna of the Aral Sea and preserve it as an industrial reservoir acclimatization studies were successfully carried out on establishing *Paranysis*, *Nereis* and *Abra* (7, 8). Under conditions of a deteriorating water supply, the sharp reduction in run-off taken for irrigation needs and against the background of a natural water shortage and increased salinity of the sea the question of whether the acclimatizants will survive in its ecosystem and what the prospects for their further development are, is most timely.

The goal of the present investigation was the evaluation of the significance of the acclimatized organisms for the productivity of the benthos of the Aral Sea and identification of the causes which determine their growth.

The collections and observations were conducted in 1973-1974. In 1973 samples were taken from the e/s [expedition vessel] "Otto Shmidt" in July in the Bol'shoye Morye only* (86 stations); in 1974 three trips were made (258 stations). Samples obtained in the coastal zone of the sea (117 in 1973 and 79 in 1974) and at a fixed point in Sary-Chagonak Bay (20 samples) were also used. Altogether 560 samples were analyzed. Thus the observations covered the Bol'shoye Morye and Maloye Morya and also the eastern coast which is shallow and sharply indented with coves. The network of stations is the same as in the 1960's (15).

* The division into the Bol'shoye Maloye Morye was adopted by L. S. Berg. The Kug-Aral Peninsula divides the sea into two parts nonidentical in area, depth, temperature, currents, bottom and other parameters.

The biomass of the benthos and its components was estimated by the surface method taking into account the bottom and the depths. The dimensional and gravimetric composition of the acclimatizants (12) was determined. (Mysidae were measured from the frontal edge to the end of the telson). In order to take into account the numbers and distribution of Mysidae, catches (47 samples) by the trawler Ostrounova (trawl area of 61 m²) were used. Catches were conducted from the shore on the eastern coast of the sea from the sea of Akzholpas in the north to the island of Tigovyy Khvost in the south. Eighteen experiments were conducted on the adaptation of Mysidae to the Aral water (4).

Before the regulation of the tributaries of the Aral Sea its forage bottom fauna consisted of fresh-water (insect larvae, oligochaetes) and salt-water (Adacna, Dreissena) invertebrates. Euryhaline aborigines (Cardium, Hydrobia) comprised as much as 2 percent of the biomass (14).

It is well known that the intensity of the development of the benthos is determined by the level of salinity, the character of the bottom, the presence of underwater vegetation, the temperature and similar factors (3, 11, 14, 15). Regulation of the run-off of rivers led to change in the bihydrological conditions of the sea (10), in particular to an increase in the area occupied by gray silt, a reduction in the zone of sea with underwater vegetation as the result of the drop in the sea level and dessication of the shores and an increase in salinity (as much as 12.5 percent on the average in 1974 with fluctuation from 12.0-14.6 percent).

The Aral Sea benthos consists basically of worms and mollusks. After regulation its species composition changed first of all. At the present time there are no larvae of Chironomidae, dragon flies, caddis flies or oligochaetes here. Six species of mollusks and one species of worms have been counted. The Azov-Black Sea forms, reinforced by Abra and Nereis settlers, dominate in numbers and biomass.

Before the regulation several biocenoses were distinguished in the benthos: coastal, on Chara, on silts, and others (14). With the change in the character of the bottoms, the area occupied by them, the disappearance of coastal vegetation where phytophilous mollusks (Dreissena and Lunka) grew in great numbers, by 1973-1974 Nereis and Abra had become the dominant forms; other forms lost their significance and thus the entire bottom population is considered to be a single biocenosis in which acclimatizants dominate (table 1 [table not reproduced]). On gray silt they are complemented by Cardium; on muddy sand by Hydrobia.

Thus, owing to acclimatization of invertebrates the biomass of the Aral Sea benthos significantly increased despite the negative effect of regulation of the rivers. Even in 1974, which was a dry year, at the time of an acute shortage of run-off the intensity of reproduction of euryhaline acclimatizants did not drop, and this, in the final analysis, determined the increase in the biomass in comparison with the previous period (table 2 [table not reproduced]). The biomass of Nereis and Abra has been growing from year

to year (see table 3 [table not reproduced]).

Nereis has occupied all bottoms and depths of the sea. The frequency with which it is encountered is 85-95 percent. The density index is 29. It is not numerous in the shallow coastal zone; in the sea itself, however, it creates a considerable biomass on fluid silts. The maximum quantities ($1.8-2.4 \text{ g/m}^2$) are noted on gray silt at a depth of 10-20 m; on black silt its biomass amounts to 2.2 and on sand (coast)--as much as 0.4 g/m^2 in distinction from the Azov Sea on the coast of which the population density is greatest (3). The sandy bottom of the Aral Sea, which is devoid of vegetation and silt, is not conducive to the growth of worms.

Nereis breeds in June, the young settling in the coastal region at a depth of 1-1.5 m, and then the worms migrate into the sea. Therefore their mean weight in both zones is also different (table 4 [table not reproduced]). In adult individuals it fluctuates from 5 to 1610 mg.

The increase in the biomass of the *Nereis* population in recent years under conditions of increasing salinity makes it possible to hypothesize that this settler has adapted well to the new conditions, and considering his euryhaline nature it is also possible to prognosticate a high biomass with further increase in the salinity of the sea.

Abra were first discovered in the Aral Sea in 1967, 80 percent of their numbers was young 1-3 mm long. In recent years they have taken a dominant position maintaining the same high intensity of growth as in the Azov Sea. By 1974 this mollusk occupied 60 percent of the area of the bottom (35000 km^2). The maximum biomass (as much as 140 g/m^2) was noted on gray fluid silts; the coefficient of specific production was close to that in the source reservoir: 1.6 (13). This made it possible to consider that settlement of the mollusk in the Aral Sea had been successful, and it has actively penetrated the bottom biocenosis.

As observations have shown *Abra* has completely forced out other mollusks (*Adacna*, *Dreissena*) in feeding barbel and bream. The mollusk's euryhalinity is responsible for its dominance in the benthos despite the increase in salinity. With further increase in it still more intensive growth of *Abra* in the benthos must be expected.

Settlement of *Mysidae*--*Paramysis intermedia* Czern. and *P. ullaskyi* Czern.--in the Aral Sea began in 1958; the first crayfish were discovered in 1961 (7). They are concentrated in the coastal zone of the eastern part of the sea at depths of up to 2.5 m. The bottoms here are usually sandy and slightly silty. The number of *Mysidae* dropped sharply with an increase in the salinity of the sea. In 1967-1968 more than 100 specimens/ m^2 were counted in the region of Abbasa and Kara-Terani (7), while in 1973-1974 there was less than 1 specimen ($0.01-6 \text{ mg}$) per 1 m^2 . The density of crayfish in the Aral Sea is significantly less than in the reservoirs of Central Asia and Kazakhstan (in Chirkurganskoye, for example, it is

1-200 specimens/m² and 1.2-1.5 g/m² (9)).

P. intermedia is most numerous in the Aral Sea and in the lake systems of the Aral basin. Its length in the sea is 3-13 mm. The weight of individuals 3-5 mm long does not exceed 1 mg. The mean length of crayfish in the sea is 6.13 ± 1.63 mm. The dimensions of Mysidae are the same in the lake systems but the weight is greater. The number of them in one trawl (trawl area 61 m²) in 1973 varied from 3 to 1146 (202 on the average) specimens; in 1974, from 1 to 272 (31) specimens. In the lakes their number fluctuated from 3 to 389 (245) specimens in 1974.

In recent years the age composition of the Mysidae population has also changed. In 1967 females comprised 42 percent (including 32 percent productive females); males--27 percent; fry--31 percent (8). By 1974 the number of productive females in the population had dropped to 11-26 percent, and with the sharp increase in salinity in the same year fry decreased three-fold in comparison with 1973 (13.4 percent versus 44.7 percent).

The distribution of Mysidae in the sea is caused by the amounts of salinity. The maximum numbers were recorded in estuary regions of rivers: in 1974 36 specimens were counted in one trawl in the estuary of Syr-Dar'ya and Amu-Dar'ya; 8 in the Maloye Morye and 10 in the Bol'shoye Morye. The salinity fluctuated from 12.6 to 14.7 percent. In 1971 at a salinity of 6-11 percent up to 298 specimens were caught in the estuaries of the rivers; 145 in the Maloye Morye and 16 in the Bol'shoye Morye. The reduction in the numbers of Mysidae in the Aral Sea can be explained by the effect of salinity and by their being eaten by fish.

The capacity of Mysidae for physiological adaptation was demonstrated in the experiment. For this purpose the salinity was increased from 12.7 to 19.3 percent with a 2 percent interval (4). In water with a salinity of 14.7 percent 33 percent of the crayfish died; at 16-20 percent, 100 percent. In the control (sea water with a salinity of 12.7 percent) the wastage of crayfish was 66.6 percent. Crayfish did not molt in the salty Aral water; consequently their growth was retarded.

The experiments showed that Mysidae do not adapt to Aral water with increased salinity. In the biological basis of the settlement of Mysidae it was indicated that Aral water with a salinity of 12 percent retards their respiration but at 13 percent salinity it accelerates, on the whole creating unfavorable conditions for the vital activities of the crayfish (4). The experimental data and the results of observations in the sea in 1974 show that the optimum conditions for survival of the Mysidae is ten-percent salinity; they yield maximum numbers at 0.5-5 percent (1,2).

Another factor of no small importance for the decrease in the numbers of Mysidae may be their being eaten by fish. Mysidae comprise 15-100 percent (by weight) of the ration of the current year's brood and the fry of *Aspius aspius*, carp, pike perch, and bream. Given the numbers of

fry in the grazing zone it can be hypothesized that their requirement for Mysidae is about 286 centners. At very low numbers of Mysidae (0.01 specimens/m²) their residual biomass measured only 13 centners in 1974 for example.

Thus the low salt-resistance of Mysidae gives a basis for assuming that in future their numbers will not be great.

On the whole it can be affirmed that acclimatization of mollusks, worms and Mysidae has a positive effect on the productivity of the Aral Sea fauna. This fact is evidenced by the high values of the population size and of the biomass of the acclimatizants and the effective use of them by fry and adult fish in the sea. Only euryhaline settlers (Abra and Nereis), however, will remain in the biocenosis of the sea with further reductions of fresh-water run-off and increases in the salinity of the water. Mysidae, however, will remain only in the estuaries of the rivers when there is minimal run-off. Nonetheless, acclimatization guarantees the creation of a reserve of benthos forage in the long run. Considering the fact that by 1980 the salinity of the water will increase to 19 percent (GOIN [State Oceanographic Institute] data), it may be hypothesized that the benthos will chiefly consist of euryhaline settlers--Abra and Nereis. With an increase in salinity and a decrease in fresh-water run-off shrinkage of the bottoms, for example by 1990, is possible. In this the geographic range and biomass of Abra and Nereis will apparently be reduced. Despite this prospect acclimatization of benthos euryhaline hydrobionts should be considered advisable.

BIBLIOGRAPHY

1. Bekmurzayev, B. "Distribution and Survival of *Parasysis intermedia* Czern. in Waters of Different Salinities in the South of the Aral Sea," in *in* *GIDROBIOL. ZHURN.* Vol 5, No 5, 1969.
2. Bekmurzayev, B. "Data on the Biology of Mysidae Acclimatized in the South of the Aral Sea," in "Biologicheskiye osnovy rybnogo khozyaystva vodoyemov respublik Sredney Azii i Kazakhstana" [Biological Bases of Pisciculture in Reservoirs of the Republics of Central Asia and Kazakhstan], Ashkhabad, 1970.
3. Vorob'yev, V. P. "The Aral Sea Benthos," *TR./AsChernIRO*, No 13, 1949.
4. Karpevich, A. F. "The Hardiness of Fish and Invertebrates With Changes in the Salinity of the Environment: and Methods of Determining It," *TR./KARADAG. BIO. STANIYA*, No 16, 1960.
5. Karpevich, A. F. "Biological Basis of Acclimatization of Aquatic Organisms in the Aral Sea," *TR./IIRMO*, Vol 43, No 1, 1960.

6. Karpevich, A. F. "Biological Bases of Acclimatization of Mysidae in the Aral Sea and In Several Other Salty Bodies of Water," TR./VNIRO, Vol 43, No 1, 1960.
7. Kortunova, T. A. "On the Distribution of Acclimatized Mysidae and Nereis in the Aral Sea," in "Akklimatizatsiya ryb i bespozvonochnykh v vodoyemakh SSSR" [Acclimatization of Fish and Invertebrates in Bodies of Water in the USSR], Moscow, Nauka, 1968.
8. Kortunova, T. A. "Some Results of Acclimatization of Forage Invertebrates in the Aral Sea," TR./VNIRO, Vol 76, 1970.
9. Ledyayeva, A. I. "Mysidae in the Chirkurganskoye Reservoir," in "Biologicheskiye osnovy rybnogo khozyaystva vodoyemov respublik Sredney Azii i Kazakhstana," Ashkhabad, 1974.
10. Markova, Ye. L.; Proskurina, Ye. S. "Current Status of Stocks of Fish in the Aral Sea and Their Forage Base under Conditions of Regulation of Run-off of Syr-Dar'ya and Amu-Dar'ya," in "Biologicheskiye osnovy rybnogo khozyaystva vodoyemov respublik Sredney Azii i Kazakhstana," Ashkhabad, 1974.
11. Osadchikh, V. F. "The Dynamics of the Biomass of the Zoobenthos of the North Caspian," TR./VNIRO, Vol 101, 1974.
12. Pravdin, I. P. "Rukovodstvo po izucheniyu ryb" [Manual on the Study of Fish], Moscow, Pishch. prom., 1966.
13. Proskurina, Ye. S. "The Biomass, Production and Demand for *Abra ovata* (Philippi) in the Aral Sea," TR./III C*EZD VGBO, Vol 1, 1976.
14. Yablonskaya, Ye. A. "The Current Status of the Aral Sea Benthos," TR./VNIRO, Vol 63, No 1, 1960.
15. Yablonskaya, Ye. A.; Kortunova, T. A.; and Gavrilov, G. B. "Many Years of Change in the Aral Sea Benthos," TR./VNIRO, Vol 80, 1973.

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BEHAVIORAL DISTINCTIONS OF THE GREAT GERBIL RHOMBOMYS OPIMUS (RODENTIA, CRICETIDAE) STRICKEN WITH PLAGUE IN THE PRESENCE OF CHANGE IN POPULATION DENSITY

Moscow ZOOLOGICHESKIY ZHURNAL in Russian No 6, 1979 pp 890-895

[Article by A. A. Karpov and G. A. Korneyev, Central Asian Scientific Research Institute of Plague Control (Alma-Ata)]

[Text] The behavioral distinctions of the great gerbil are discussed as related to difference in population density against the background of epizootic plague. Most animals with the acute form of this disease could be clearly distinguished by their appearance and behavior for 1-3 days. Members of a family group did not avoid sick specimens, but displayed watchfulness if a fresh carcass was present. The usual stereotype of great gerbil behavior did not change, in spite of the plague epizooty, until there was a drastic reduction in number of animals and the specimens were separated in space.

Questions of ecology of the great gerbil (*Rhombomys opimus* Licht.) have attracted the attention of a wide circle of researchers for many years. There has also been repeated discussion of the distinctions of intraspecific relations between gerbils during periods of epizootic outbreak of plague (Varshavskiy et al., 1957, 1975; Dubyanskiy, 1963, 1974; Kirsanov, 1972); however, thus far no comprehensive studies had been made of the behavior of these animals in the presence of differences in population density against the background of an epizootic outbreak of the disease.

We conducted our studies in 1971-1976 in the northeastern part of Myunkumy (Chu-Tulass interfluvial region) over an area 10,000 ha [hectares] in size, and in greater detail over an area of 4 ha situated in the approximate middle of this region. The latter consisted of a sandy, hilly plain with Chernsaks villages and uniform great gerbil settlements (up to 4-6 colonies per ha). In the fall of 1971, after a 6-year interval, there was an epizootic outbreak of plague there (Bykov et al., 1974), which reached

maximum distribution in the northeastern part of Muyunkumy in the summer of 1973. The presence of strains of plague pathogen in this area was recorded every spring and fall through 1974.* At the start of this outbreak (fall of 1971), the great gerbil population density constituted 14.7 specimens per ha, and it increased thereafter. Maximum density was reached in the fall of 1973 (34/ha); however, it decreased drastically by the fall of 1974 (to 4.2/ha), and the animals were subject to the maximum elimination in the summer and fall, at the early postnatal stage.

We mapped the colonies on the 4-ha plot and trapped virtually all of the gerbils annually (in March, April-May, September-October and in some cases additionally in August or November-December). The animals were swabbed with ursall, marked by amputation of digits and released in the place they were trapped. At each stage of the study, we observed marked specimens (up to 136 animals during the period of maximum population) for 3-15 days. We took only carcasses and animals in a state of agony for bacteriological studies in order to retain as much as possible the natural structure of both the population of carriers and the parasitic system as a whole. Infected gerbils were found in this area in the spring of 1972 and 1974.

The first sick animal on the plot was found on 16 May 1972 in colony No 14 (see Figure), in a family group consisting of an adult male and female, and 6 young animals about 1 month of age. One of the young specimens was less active: it ate little, kept apart from the others and often sat with the eyes slightly closed. The other animals in the litter tried to make contact with it, but it avoided socializing. Its condition worsened on the following day: it reacted poorly to danger, and on the morning of the 3d day it was found in the colony in an agonal state, with impaired coordination of movements. Plague was diagnosed bacteriologically.

It can be stated with certainty that this animal was infected in its own colony (the young animals had just begun to come up on the surface and did not leave the family area). What is important is that all the other gerbils in this group survived until fall; some of the young specimens were trapped the following year, while one female from this litter was trapped in the same colony in the spring of 1974. The colony remained inhabited throughout the years of observation.

During the same period (24 May 1972), a dead female was found on the surface in one of the colonies nearby (No 19) inhabited by an adult male and female, with a litter of 6. Plague culture was isolated from the carcass. The disease was not found over the next 10 days among the rest of this family. The colony was also inhabited in subsequent years.

*O. Ya. Gordiyenko and M. I. Matakoy, bacteriologists at the Dzhambulskiy plague control department, made the identification of *Yersinia pestis*.

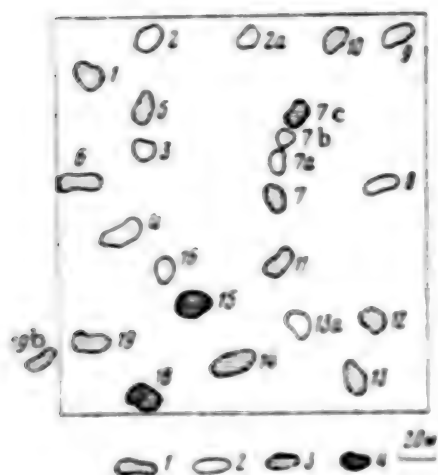


Diagram of location of great gerbil colonies in the observed area (Muyunkumy, 1972-1974). The numbers refer to colony No

- 1) inhabited colonies
- 2) colonies not inhabited in the spring of 1974 (they were inhabited by gerbils in 1972-1973)
- 3) colonies with plague-stricken animals in 1972
- 4) the same in 1974

In spite of the widespread plague epizootic in the fall of 1972 and, particularly, in 1973, in northeastern Muyunkumy, we did not encounter animals with external signs of the disease in the area.

Infected gerbils were again found within the observation area in the spring of 1974. In colony No 18 (adjacent to previously infected colonies 14 and 19), inhabited by an adult male and female, the male developed signs of the disease on 23 April: his fur was ruffled and activity diminished. He took virtually no food and walked in a hunched position. Signs of adynamia progressed on the following day, movements became uncertain and there was a marked decrease in reaction to danger. However, the female did not avoid him and occasionally tried to clean him. Once, the female jumped over the sick animal, which is typical behavior with young, hierarchically subordinate specimens. By the evening of the 2d day, the male was in a serious condition: he sat with ruffled up fur, rocking slightly with the eyes closed. It was possible to come right up to him and destroy him.* The female was cautious about the carcass: with her fur ruffled she inspected it on all sides. Then she began to eat nearby emitting alarm signals ("tapping").

After the male died, there was redistribution of this family section, which is common when there is a high population density (Karpov, 1974). On the day after placing the carcass in the area, a new male (male A) tried to settle in this colony; he had been previously seen in the settlements. The new arrival carefully inspected the carcass and marked it by crawling over it. This procedure is known in great gerbils with regard to young animals and unfamiliar objects (Lobachev, Pashkina, 1972; Sokolov et al., 1972;

*Subsequently, plague was confirmed bacteriologically.

Gol'tsman, Paskhina, 1974), but had not been observed with carcasses. Moreover, male A made several marks in the colony in the form of "storozhki" [guarding?] signals (piles) and he ate close to the carcass.

On the same day, a stronger male B, who lived in colony No 19b with a female, added this colony to his area. Having inspected the marks near the peripheral burrows he boldly followed them to the middle of the colony and chased male A away, and the latter offered no resistance. The female tried to defend her family place, but was compelled to withdraw to the periphery, since the new male displayed considerable aggressiveness. Male B marked the colony with several piles or "storozhki" (Lobachev, Paskhina, 1972; Naumov et al., 1972), replacing the marks of his predecessors (the former inhabitant of the burrow and male A). He marked some protruding objects with urine. During the day, male B repeatedly returned to this colony, leaving new marks and aggressively pursuing the female. However, this was not the end of redistribution of the partially vacated family place (one female remained).

On the same day, another male (C) appeared in Colony No 18 from another adjacent one (No 15) which he occupied with a female. Male C carefully inspected the peripheral markings, removed a pellet of feces from one of the piles and, holding it in his front legs, carefully sniffed it, after which he proceeded to the middle of the colony. The appearance of a new male exacerbated the conflict situation. Male B upon detecting the new arrival ruffled his fur and assumed a menacing lateral position. However, male C assumed a protective frontal position and did not retreat. The ritual of threats did not last long and changed into a battle with the actions typical of great gerbils: jumping up to 20-30 cm with efforts to overturn the opponent, striking with the hind legs and biting. Nervous twitching of the tip of the tail was the sign of start of the attack. The fights were repeated twice. Male C was the victor.

On the next 4 days there was formation of a new family group. First there was less aggressiveness in the relations between male C and the female from colony No 18. Then the pursuit began to resemble play. When retreating, the female often assumed subordinate positions, and occasionally some similar to lordosis. On one day, they were observed grooming one another, and this was initiated by the female. This was followed by mating. Now male C spent most of the daytime in colony No 18, but he spent the night in No 15. He would deliver small amounts of feed to both colonies.

On the 6th day (2 May) after the first contact between male C and "plague" colony No 18, the female in colony No 15 presented signs of the disease. On the morning of 3 May there was significant worsening of her condition. In spite of the cool weather she preferred to remain on the surface and sat in a hunched position, near one of the burrow holes. In the afternoon, it became possible to come close to the gerbil and destroy her. Male C was cautious about the carcass (like the female previously in colony No 18) and inspected it thoroughly on all sides.*

*A plague culture was isolated from the carcass and *Xenopsylla gerbilli minax* flea found on it.

The female in colony No 18 also began to present external signs of disease in the next 3 days (4-6 May). On the 1st day, this was manifested by diminished activity and sitting motionless with the eyes slightly closed for 5-10 min at a time. The fur remained smooth. On the 2d day, activity diminished even more and the fur became ruffled; the gerbil ate little. On the 3d day, the female was found in a caved-in section of the colony. She spent all day on her belly, occasionally altering her position and emitting moaning-rumbling sounds when she did so. Toward evening, when it cooled off, the female had even more ruffled fur and sat, extending the head toward her belly in the hunched position that is typical for sick animals. She did not react to the presence of the observer. Before sundown, the female went deep into the colony and never reappeared thereafter. Male C continued to visit both colonies, leaving marks in the form of droppings, as well as adjacent vacant colonies (No 16, 4). Soon colony No 18 was occupied by a new female, that had not been previously marked. She moved in without manifestation of aggressiveness between animals.

In addition to this group of "plague" colonies, colony No 7c (140 m away from the closest plague-ridden one) was also found to be infected at this time. On 5 May, a female carcass was found there. On the previous day, there were very insignificant external signs of illness, and they consisted of some passiveness. In the laboratory, a plague culture was obtained from the carcass, as well as two cultures from *Xenopsilla gerbilli minax* and *Ceratophyllus laeviceps* fleas collected from the carcass. No direct contacts had been observed between the inhabitants of colony No 7c and preceding infected colonies.

In the fall of 1974, colonies 15 and 18 were vacant. However, the former was settled by a new family of gerbils in the spring of 1975, while the latter was visited by the animals. In the fall of 1974, colony No 7c was inhabited, but in 1975 it was only visited by animals. The low occupancy of colonies in these seasons in the observation area was the result of general depression in gerbil population. We failed to detect plague pathogens in 1975-1976, either in the observation area or the entire surrounding 10,000 ha, which was indicative of termination of the epizootic in this region.

In view of the fact that plague epizootics usually develop against a background of already declining population of great gerbils, the external signs of epizootics in settlements of these rodents correspond on the whole to the scale developed by Varshavskiy et al. (1975). However, in the case we have discussed, the animals began to contract plague prior to reduction in their number (at the last stages of increase in population density). This enabled us to detect a number of changes in the usual behavior of the specimens, which were related both to development of the epizootic and start of depression of population size.

The external signs of an epizootic, in particular, disruption of sonic signaling by the animals (appearance of "zones of silence"), increased cautiousness of most animals, appearance of vacant or poorly developed

colonies, all of which have been mentioned by a number of authors (Varshavskiy et al., 1957, 1975; Dubyanskiy, 1963, 1974; Kirsanov, 1972), began to appear in our observation area only in 1974, i.e., 2.5-3 years after the start of the epizootic. At this time, the epizootic had stopped and a sharp reduction in number of gerbils began. The above behavioral distinctions in great gerbils are apparently indications of general reduction in number (spatial separation of animals and disruption of family group structure), which did not necessarily occur as a result of the epizootic process, rather than of an epizootic outbreak. Kuzyakin (1939) had already mentioned the silence and reticence of great gerbils in the presence of a profound depression of population thereof.

Analysis of spatial distribution of sick animals revealed that the structure of the smallest epizootic units (small sites, or groups of plague colonies) in our observation area was generally consistent with the previously expounded conceptions (Soldatkin et al., 1968; Rotshil'd, 1973, and others). We defined some elements of contacts between animals within these sites, and we also traced the dynamics of development and time of existence of the latter. Under natural conditions, cases of plague among great gerbils were recorded in a group of four adjacent colonies and one somewhat farther away. In the group of adjacent colonies, there was a total of 5 sick animals (2 out of 14 contacted in the spring of 1972 and 3 out of 7, in the spring of 1974). The distances between colonies ranged from 20 to 70 m, and the overall area of family sectors of animals living there did not exceed 0.5 ha. We cannot rule out the possibility of a larger sized site, as indicated by the discovery of a sick gerbil in the spring of 1974 in a colony 140 m away. The demonstrated site had apparently existed for at least 3 years (1972-1974).

Development of the epizootic in the area in the first few years (1971-1973) was not associated with mass scale extinction of great gerbils. The number of animals continued to increase under these conditions, reaching a maximum in the 3d year of the epizootic (in 1973), after which there was a drastic reduction in number of these rodents.

Plague infection in gerbils, with acute course of the disease, differed in nature in different years among animals that were contacts. Thus, in 1972, no animals contracted the disease among 14 that had been in contact with 2 sick ones (probably there had also been contact with infected fleas). In 1974, 3 animals were stricken with the acute form of plague out of 7 that had been in contact with one another and visited infected colonies. However, a change in susceptibility of rodents to infection at different stages of fluctuation in size of population thereof could be one of the possible causes of differences in intensity of the disease in different years (Korneyev, 1977).

The obtained results enable us to derive the following conclusions:

1. Most gerbils with acute form of plague could be clearly distinguished by their appearance and behavior for 1-3 days. Such animals were inactive, presented a drowsy state, ate virtually nothing and assumed typical

hunched positions (which was also noticeable when the animals ran), and coordination of movements was impaired. Sick gerbils reacted little to danger, their fur was ruffled and dull. However, some animals died with barely noticeable external signs of the disease (2 out of 6).

2. Family group members did not avoid sick animals and tried to socialize with them in the usual manner of healthy specimens, which could intensify epizootic contact. The presence of fresh carcasses in a colony caused noticeable cautiousness among other members of the family group, although it did not cause them to leave the colony.

3. "Outsiders" (animals from adjacent colonies) did not occupy colonies during the period of illness of their occupants, and they did not attack sick animals. However, death of a gerbil stimulated intensive migration of new specimens to the colony, as well as appropriation of partially vacated colonies by adjacent family groups.

4. The marks of great gerbils in colonies, in the form of "storozhki" signals (piles) apparently contain information about the composition and condition of a specific family group. Animals from other family groups make constant use of this information.

5. There is no change in the usual stereotype of behavior of great gerbils within a population, in spite of a plague epizootic, unless there is a drastic reduction in their number leading to spatial separation of animals.

BIBLIOGRAPHY

1. Bykov, L. T.; Kukin, V. M.; Onishchenko, L. P.; and Trofimenko, I. P. "Distinctions of Plague Epizootic in Northeastern Muyunkuny Near Chuyskiy in 1971-1972," in "Materialy VIII nauchn. konf. protivochumn. uchrezhdeniy Sredney Azii i Kazakhstana" [Proceedings of 8th Scientific Conference of Plague-Control Institutions of Central Asia and Kazakhstan], Alma-Ata, 1974, pp 154-156.
2. Varshavskiy, S. N.; Rotshil'd, Ye. V.; and Shilov, M. N. "Methods of Detecting Epizootics and Microsites of Plague in Settlements of Great Gerbils According to External Signs of Colonies," "Nauchn. konf. po prirod. ochagov. i epidemiol. osobe opasnykh infekts. zabolevaniy" [Scientific Conference on Natural Endemicity and Epidemiology of Particularly Dangerous Infectious Diseases], Saratov, 1957, pp 79-83.
3. Varshavskiy, S. N.; Shilov, M. N.; Lavrovskiy, A. A.; and Varshavskiy, B. S. "Methodological Recommendations and Scale for Detection of Plague Epizootics According to Set of External Signs of Condition of Rodent Settlements," Saratov, 1975, pp 1-28.

4. Gol'tsman, M. Ye., and Pashkina, N. M. "Elements of Social Behavior of Great Gerbils," BYULL. MOSK. O-VA ISPYTATELEYE PRIRODY, OTD. BIOL. [Bulletin of the Moscow Society of Naturalists, Biology Section], 79, 2, 1974, pp 29-38.
5. Dubyanskiy, M. A. "External Signs of Plague Epizootics in Great Gerbil Settlements at Different Phases of Development Thereof," "Materialy nauchn. konf. po prirod. ochagov. i profilaktike chumy" [Proceedings of Scientific Conference on Endemicity and Prevention of Plague], Alma-Ata, 1963, pp 76-78. "Procedures for Searching for Animals Infected With the Pathogen of Plague in Settlements of Great Gerbils," in "Materialy VII nauchn. konf. protivochumn. uchrezhd. Sredney Azii i Kazakhstana," Alma-Ata, 1974, pp 164-167.
6. Karpov, A. A. "Some Features of Ethology of the Great Gerbil," Ibid, 1974, pp 251-252.
7. Kirsanov, M. P. "External Features of Settlements as an Indicator of Epizootic Status of Great Gerbil Population in Caspian Region of Karakumy," in "Problemy osobo opasnykh infekts." [Problems of Particularly Dangerous Infections], Saratov, 2, 24, 1972, pp 79-82.
8. Korneyev, G. A. "The Role of Changes in Population Density in Sensitivity of the Great Gerbil to Y. Pestis," in "Ekologiya i meditsinskoye znachenie peschanok fauny SSSR" [Ecology and Medical Significance of Gerbils of the USSR Fauna], Moscow, 1977, pp 290-293.
9. Kuzyakin, A. P. "Data on Ecology of Mammals of the Kashano-Murgab Valley With Consideration of Their Role in Epidemiology of Cutaneous Leishmaniasis," in "Sb. nauchn. stud. rabot, Zoologiya" [Collection of Scientific Student Works: Zoology], Izd-vo Mosk. un-ta [Moscow University], 9, 1939, pp 5-40.
10. Lobachev, V. S., and Pashkina, N. M. "Behavior and Activity of the Great Gerbil," in "Povedeniye zhivotnykh" [Animal Behavior], Moscow, Izd-vo Nauka, 1972, pp 220-222.
11. Naumov, N. P.; Lobachev, V. S.; Dmitriyev, P. P.; and Smirin, V. M. "Endemic Plague Site in Aral Region of Karakumy," Izd-vo Mosk. un-ta, Moscow, 1972, pp 1-405.
12. Retshil'd, Ye. V. "Spatial Structure of Endemic Plague Site and Methods of Studying It," author abstract of doctoral dissertation, Saratov, 1973, pp 1-30.
13. Sokolov, V. Ye.; Smirnova, O. V.; Chernyshova, N. B.; and Nikitina, S. B. "Endocrine Glands and Their Role in Vital Functions of the Great Gerbil," in "Povedeniye zhivotnykh," Izd-vo Nauka, Moscow, 1972, pp 222-224.

14. Soldatkin, I. S.; Rudenchik, Yu. V.; Ostrovskiy, I. B.; Klíмова, Z. I.; Mokriyevich, N. A.; and Severova, E. A. "Seasonal Changes in Conditions Under Which Plague Pathogen is Passed Among Great Gerbils in Kyzylkumy," in "Gryzuny i ikh ektoparazity" [Rodents and Their Ectoparasites], Saratov, 1968, pp 111-118.
[617-10,657]

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ROLE OF CANNIBALISM IN ONSET OF TULAREMIA WITH NONLETHAL COURSE IN
HIGHLY SENSITIVE COMMON VOLES

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[Article by N. G. Olsuf'yev and K. N. Shlygina, Institute of Epidemiology
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[Text] Common voles (*Microtus arvalis* Pall., *M. subarvalis* Meyer et al.) play a first and foremost role in maintaining the meadow-filled and steppe endemic sites of tularemia, which are widespread in European USSR. With periodic growth in number of voles, tularemia epizootics spread in the population thereof, and they are associated with mass scale death of the animals. Common voles are highly sensitive to tularemia: they die of acute infection when single tularemia bacteria of a virulent strain are injected hypodermically. In the case of infection via the alimentary route, the lethal dose for voles is higher and constitutes 1-10 million bacteria; only some of the animals die with lower doses. We failed to demonstrate signs of the disease in surviving animals; analogous negative results were obtained in the United States (Stewart and Bell, 1976) who fed *Microtus pennsylvanicus* a live culture of a virulent strain.

In the last few years, some very reliable cases have been reported of demonstration of antibodies to the pathogen of tularemia (Bessalov, 1968; Ivanov et al., 1970; Dobrokhotov and Meshcheryakova, 1974; Algazin et al., 1977) in blood serum of some small mammals (hares, water rats, lemmings, Middendorf voles and others) that are highly sensitive to tularemia. These findings warrant the belief that a nonlethal outcome of the disease is possible in highly sensitive animals, that they form immunity and become carriers, participating in retaining the infection in endemic sites.

We know of cases of survival of highly sensitive animals after tularemia in experiments involving preimmunization thereof with live vaccine from cells with attenuated virulence or high doses of killed bacteria. This suggested to us that it is possible to induce nonlethal tularemia infection in common voles by administration of quite virulent bacteria mixed with killed ones via the alimentary route. Prevalence of killed bacteria in the mixture could, to some extent, neutralize the pathogenic effect of the live ones.

Under natural conditions, the alimentary route of tularemia infection of voles is widespread, particularly when they consume dead animals (cannibalism, necrophagia). During the cold period of the year this is the main route of transmission of infection among voles, particularly when they settle in straw and hay stacks, and other closed areas. According to our data, immediately after death due to tularemia, there is a mean of 1-10 billion or more live bacteria per gram vole carcass and 7.5-100 billion per gram parenchymatous organs (spleen, liver, lung) (assayed by preparing a suspension of macerated tissues in saline and inoculating it on nutrient media, followed by counting grown colonies). There are so many bacteria in any tissue of a vole that died of tularemia that even minimal chewing on its carcass is sufficient for infection with lethal outcome. The pathogen may survive for months in the frozen carcasses of the animals, and there could be more dead cells than live ones as a result of extinction of bacteria in carcasses that have not been disposed of. By consuming such carcasses, the voles can ingest a mixture of live and dead bacteria.

To check this hypothesis, we conducted two series of experiments on adult voles raised in the laboratory. Karyotype identification of the voles was made by V. N. Yatsenko (Institute of Evolutionary Morphology and Ecology of Animals, USSR Academy of Sciences), for which we express our sincere gratitude. Experiments were conducted with virulent standard strain 503 of tularemia, of the holarctic race (*Francisella tularensis* *holartica* Ols.).

The first series was conducted using an original method of measured feeding of a mixture of live and killed bacteria. The bacteria were cultured for 2 days on blood agar or coagulated yolk medium. We inactivated bacteria in saline by heating them for 30 min at 60°. The mixture was prepared just prior to the experiment and introduced in the voles' esophagus with a syringe, through a needle with a bulb at the tip. The tested doses constituted 5-10 billion killed bacteria and 1000 to 5 million live microbial bodies (according to cloudiness standard, 10 units GISK [not further identified]). There were 1000 to 1 million times more killed bacteria than live. The mixture of killed and live bacteria was prepared in a proportion of 4:1, and given in amounts of 0.5 ml once or several times (2, 3 and 6 times) at intervals of 1 day or more. In the case of repeated infection the number of live bacteria in the mixture was increased by 10 times with each administration (or series of daily administrations). Thus, the number of killed bacteria ingested ranged from 5 to 60 billion and the number of live ones, from 10,000 to 5 million.

In all, we infected 309 voles. A total of 153 animals died of tularemia and 27, of extraneous causes. The surviving 117 voles were sacrificed 20-27 days after the last feeding of bacteria, and 12 15-18 days after (after infection via the alimentary route the voles die within 5-13 days). Antibodies to *F. tularensis* were demonstrated in 9 animals (6.9%); the titers constituted 1:15-1:1280 in the agglutination reaction and 1:16-1:1600 in the passive hemagglutination reaction (the latter was run by I. S. Meshcheryakova, and we wish to express our appreciation to her). Of greatest interest are two animals that were sacrificed on the 25th postinfection day. Their agglutination

reaction with tularemia microbe was positive in blood serum dilutions of 1:160 and 1:640, and hemagglutination constituted 1:1600 in the second case (this reaction was not run in the first); the original pathogen culture was isolated from viscera by means of passage through white mice. Here we had distinct proof, not only of formed immunity, but presence of the carrier state. These voles received via the alimentary route a total of 60 billion killed and 330,000 live bacteria in the first case, 30 billion killed and 30,000 live in the second.

Changes in the viscera were discovered in some of the surviving voles, particularly among the above-mentioned carriers: enlargement and consolidation of the spleen and occasionally the liver, isolated fine necrotic nodules in the tissues of these organs, enlargement of mesentery lymph nodes and Peyer's patches, etc. These changes can be interpreted as tissular reactions of the voles to invasion of infection. Survival of the animals was attributable to introduction into the gastrointestinal tract of a large number of killed bacteria and release of antigen from them, which was activated by the defense mechanisms of the body. Once formation of immunity began it inhibited development of infection induced by live virulent bacteria, and the body ultimately coped with it.

In another series of experiments, we tested the possibility of reproducing nonlethal tularemia in voles in the case of infection under close to spontaneous ones. We used the phenomenon of cannibalism (necrophagia) inherent in this animal species. We fed them on unfresh carcasses of voles or white mice that died of acute tularemia. In fresh carcasses of white mice, the number of bacteria in organs and tissues is about the same as in common voles. The voles consumed the most willingly the carcasses at minus ambient temperatures ($-3-11^{\circ}$), but in some cases they also did so at moderate plus temperatures ($2-10^{\circ}$).

The voles were kept separately in 10-liter glass jars, with shavings at the bottom and a small amount of hay and cotton. Feed was not given the animals for 1 day before the experiment, after which one carcass with the ventral side cut open was put with each vole. The carcasses had been stored for 1-1.5 months in a freezer, and they were defrosted or submitted to freezing and defrosting 1-3 times before use, in order to reduce the number of live bacteria. The number of the latter was checked by taking random samples for culture in dishes with fish-glucose-cystine blood agar, with ampicillin and polymyxin, which inhibit grow of extraneous microflora; we made cultures of a mixture of pieces of organs (liver, spleen, lungs) macerated in saline and counted the number of grown colonies. More often, the number of bacteria per gram tissue of voles and white mice constituted several tens or hundreds of millions, i.e., thousands of times less than immediately after they died (see above). For 3 days, the carcasses served as the only source of food for the voles; then the experimental animals were switched to the usual diet (red beets, oats). The carcasses were weighed daily; in 3 days their weight dropped by a mean of 8 g (from 1.5 to 20.7 g). More often, the voles ate certain parts of the carcass, particularly

the parenchymatous organs, but they occasionally consumed virtually the entire carcass, with the exception of the pelt, limbs and residue of the head.

Out of 439 voles, 203 died of tularemia and 43, of extraneous causes; 193 survived. The surviving animals were sacrificed 28-34 days (in one case 15 days) from the start of feeding them the carcass, in order to conduct serological and bacteriological tests. Antibodies to *F. tularensis* were demonstrated in blood serum in high titers in 2 voles (1 sacrificed after 29 days and the other, after 15); the titers constituted 1:320 in the agglutination reaction and 1:160 in the reaction of passive hemagglutination. In both animals, who consumed 3.2 and 5.4 g carcass tissue, there was considerable enlargement of the spleen, and in one of them there was also marked enlargement of the liver with appearance of several necrotic nodules on it. The original culture of the pathogen was isolated from the viscera of both voles after passage through white mice. A test of one of these cultures, which had been preserved in the animal for about 1 month, on white mice and guinea pigs revealed that it did not differ from the original strain in virulence.

As a result, were able to demonstrate, in 2 cases out of 193 (1%), that voles had contracted tularemia with formation of immunity and became carriers of a rather virulent pathogen of tularemia. Evidently, the same mechanism was involved in survival of the voles as in the case of dosed administration of a mixture of killed and live bacteria (see above). Antibodies to *F. tularensis* were demonstrated in small amounts in the blood serum of 5 voles that were sacrificed; the titers constituted 1:5-1:10 in the agglutination reaction and 1:8-1:16 in the hemagglutination reaction; no carriers were found. In these cases, antibody production could have occurred as a result of intake of a large number of dead bacteria, rather than contracting the disease. Examination of 203 voles that died of tularemia revealed necrosis in the spleen of 15 animals, and in 2 cases there was also necrosis of the liver, which is not typical of acute tularemia. All but two of these animals died at the late stages (10-14 days from the start of intake of bacteria). In two cases, antibodies to tularemia bacteria in a maximum suspension dilution of 1:20-1:40 were demonstrated in the passive hemagglutination test on a suspension of thoracic organs. Evidently, stimulation of defense mechanisms of the macroorganism extended somewhat the life of these animals, but it was not sufficient to prevent their death.

Thus, for the first time, it has been demonstrated that it is possible, in principle to induce nonlethal infection with formation of immunological reactions and carrier state in rodents that are highly sensitive to tularemia (common voles). The obtained experimental data could serve as an explanation for the cases of demonstration of antibodies to *F. tularensis* in wild animals that are highly sensitive to tularemia. It is quite possible that nonlethal infection may occur in nature, among highly sensitive animals when they consume not only carcasses, but feed containing live and dead bacteria. True, there are relatively rare cases of survival after tularemia, as well as of cases of demonstration of antibodies in endemic sites among

highly sensitive animals. Nevertheless, contraction of tularemia by animals followed by their becoming carriers of pathogens thereof, along with other routes, plays a role in the mechanisms of maintaining tularemia sites in nature.

BIBLIOGRAPHY

1. Algazin, I. P.; Yegorova, L. S.; Mal'kov, G. B.; and Petrov, M. I. "Data on the Study of Tularemia in Taymyr. Problems of Epidemiology and Prevention of Endemic Diseases in the Polar Region," Omsk Medical Institute, Omsk, 1977, pp 1-196.
2. Bessalov, V. S. "A Tularemia Site on Biryuchiy Island, Khersonskaya Oblast," ZH. MIKROBIOL., EPIDEMIOL. I IMMUNOL. [Journal of Microbiology, Epidemiology and Immunology], 12, 1968, pp 97-103.
3. Dobrokhotov, B. P., and Meshcheryakova, I. S. "Tularemia Epizootic in Floodplain-Swamp Sites of Western Siberia and Comparative Evaluation of Different Methods of Study Thereof," ZOOL. ZH. [Zoological Journal], 53, 11, 1974, pp 1686-1696.
4. Ivanov, V. S.; Ravdonikas, O. V.; Korsh, P. V.; Alifanov, V. I.; and Zimina, V. Ye. "Microbiological Characteristics of Tularemia Epizootic Among Muskrats and Water Voles of Lake Starich'ye," in "Vopr. infekts. patol. Materialy nauchn. konf." [Proceedings of Scientific Conference on Infectious Pathology], Omsk, Vyp 2, 1970, pp 1-375.
5. Stewart, S. J., and Bell, J. F. "Quantum Differences in Susceptibility of Voles to Virulent *Francisella tularensis*, Type B, Administered per Os. Failure of Survivors to Develop Immunity," "Proc. 31st Annual Meeting," Aug 16-18 1976, pp 1-89.
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STATUS OF SANITARY INSPECTION REFERABLE TO INDUSTRIAL HYGIENE AND SCIENTIFIC IMPLEMENTATION THEREOF

Moscow GIGIYENA TRUDA I PROFESSIONAL'NYYE ZABOLEVANIYA in Russian No 8, 1979 pp 1-4

[Article by N. F. Izmerov, V. Ye. Kovshilo and A. M. Sklyarov (Moscow), Institute of Industrial Hygiene and Occupational Diseases, USSR Academy of Medical Sciences, and Sanitary and Epidemiological Administration, USSR Ministry of Health]

[Text] The intensive development of industry confronts public health agencies with new tasks. Work pertaining to amelioration of working conditions is being pursued through the joint efforts of industrial ministries, scientific research institutes specializing in engineering and hygiene, planning and design organizations, state sanitary inspection bodies and trade union organizations.

One of the main objectives of state sanitary inspection in the USSR is to implement supervision of sanitary and hygienic measures directed toward improving working conditions and prevention of occupational morbidity. Surveillance of working conditions is implemented at all stages of industrial production, from the planning of industrial enterprises and technological processes to direct supervision of the industrial environment in which work is performed.

Preventive sanitary inspection is the most important area of these activities.

Many years of practice have shown that industrial working conditions depend primarily on the nature and condition of technological processes and equipment. They determine the formation of various harmful or unfavorable factors in the industrial environment, the nature, difficulty and hazard of work processes. For this reason, state sanitary supervision of organization of new technological processes and development of industrial equipment and machinery is the first and foremost task for industrial hygienists.

Physicians specializing in industrial hygiene must be highly qualified and very knowledgeable about industrial conditions, and they must be able to

give a hygienically correct evaluation of occurring processes in order to fulfill the task of providing healthful working conditions on a modern level. In addition, physicians in this specialty must know the sanitary and hygienic standards in effect.

It is quite understandable that the state of sanitary inspection and effectiveness of performance of inspectorate bodies with regard to ameliorating the industrial environment and lowering occupational morbidity among workers depends on how scientific institutions provide practical public health with scientifically substantiated standards.

The system of hygienic standards created in our country is a most important prerequisite for implementation of preventive measures and checking their effectiveness. It is therefore not by chance that the main direction of scientific research on industrial hygiene became, in the last few years, the development of theoretical bases for ameliorating the industrial environment, among which questions of setting hygienic standards for factors of the industrial environment and work activity occupy an important place.

Generalization of accumulated theoretical and practical material, particularly clinical statistical data, made it possible to formulate the main methodological principles of standard setting, which also take into consideration the long-term consequences of heavy and intensive labor, as well as forms of labor. On this basis, hygienic standards for chemicals, physical factors, ergonomic requirements, etc., were substantiated anew and submitted to revision.

Most MPC and MPL [maximum permissible concentrations and maximum permissible levels] were established only in experiments on animals. For this reason, correction thereof by means of clinical and hygienic studies, as well as epidemiological observations with consideration of social conditions, constitutes a serious methodological problem that must be solved.

Until recently, the maximum concentration was used as the MPC. However, experience and some scientific research revealed that the average concentrations per shift are more demonstrative for substances that have cumulative properties and present the greatest danger with long-term exposure to low concentrations. Even now, such concentrations have been proposed for substances that are widely used in the national economy (lead, cadmium oxide, metal mercury, copper, antimony).

It is extremely urgent to solve today the problem of establishing the principles for substantiation of the mean-shift MPC in the air of work zones, as well as of singling out the group of substances for which they should be set first of all.

It is imperative to continue studies dealing with development of methods and approaches to setting standards for chemicals, with due consideration of long-term consequences of exposure to them. It is particular important to develop high-speed methods of demonstrating such sequelae and establishing correlations between them.

At the present time, there is a rift between the number of established MPC for harmful substances in the air of work zones and methods of determining these MPC, which prevents proper performance of laboratory tests in the industrial zone.

Dust-borne occupational diseases are among the main problems. In the years of Soviet power much has been done to ameliorate working conditions and lower morbidity. However, the problem of control of pneumoconiosis in coal mines is far from resolved. It can be decisively resolved by developing a new technology for coal mining. However, there are also still unsolved problems of setting hygienic standards for aerosols, particular dust of mixed composition. There must be continued development of instruments for determination of dust levels.

Development of new engineering and technology satisfying hygienic requirements is the basis for the prevention of the deleterious effects of such physical factors as noise, vibration, ultrasound and infrasound. Research in this field made it possible to set hygienic standards and relevant requirements, which are now included in the state standards. This assures implementation of hygienic requirements at the stages of planning and creating new engineering and technology.

At the present time, there are GOST's for permissible levels of noise, vibration and ultrasound in the air of work zones. Supervision of adherence to these standards has been relegated not only to the sanitary and epidemiological service, but the USSR Gosstandard, as well as relevant ministries and agencies. This means that not a single machine or piece of technological equipment can be produced without checking the parameters of these factors.

Studies are in progress on the means of further refinement of setting hygienic standards for noise and vibration, differentiation of such standards according to specifics of work, difficulty and intensity thereof.

Ultrasound has found wide applications in engineering medicine and industry. Low-frequency ultrasound is generated during operation of jet engines, high-power compressed air motors and gas turbines. Hygienic evaluation of this factor, as well as assurance of safety of operating new ultrasonic technology is the next task for industrial hygiene. It is equally important to develop the principles, methods and hygienic standards for infrasound.

Development of the newest technology and use thereof in a number of branches of industry led to a new hygienic problem, "Electromagnetic radiofrequency fields" (ERF).

In assessing the existing state of affairs with regard to setting ERF standards, it must be noted that MPL have not been set for all frequency ranges, and in some of the ranges standards have only been set for one of the components of ERF, electrical or magnetic; the standards are characterized by the existence of the same MPL for wide frequency ranges. For

For this reason, at the present time it is imperative to define the hygienic standards for several frequency ranges. In the future, one should set PDL that are differentiated according to modes of generation of SHF energy and modes of irradiation of personnel. The hygienic standards in the ranges of 60 kHz-300 MHz and 1 kHz-12 kHz require definition. There must be standard sets for both components of ERF; the MPL must be differentiated according to time of exposure, since setting standards only according to field intensity is inconsistent with current conceptions of energetic determination of biological effects.

Still pressing are problems of deeper investigation of biophysical mechanisms of action of physical factors in the industrial environment (noise, vibration, infrasound and ultrasound, ERF, etc.), combinations of different physical factors with one another and with chemicals.

The achievements of Soviet industrial hygiene in the field of hygiene of the industrial microclimate are well-known. Microclimate standards for industrial buildings have been set on the basis of results of studying heat transfer between man and the environment under different meteorological conditions.

However, it is imperative to deploy research to set standards for infrared, ultraviolet radiation, ion composition of air, temperature of barriers [fencing?], as well as the combined effect of different combinations of meteorological conditions and other physical and chemical environmental factors.

Hygienists are faced with some serious tasks in the area of industrial lighting.

It is a pressing task to substantiate the transition to setting hygienic standards that provide not only for safe, but comfortable working conditions. One must undertake development of methods of studying work process factors that have a beneficial effect on efficiency and health, and substantiate the relevant standards.

Under the 10th Five-Year Plan, there has been an increase in extent of use of personnel safety devices in all branches of the national economy. There are 50-55 million workers who must use them, and this is indicative of a need for hygienic institutes to pay the most serious attention to the quality and efficacy of personnel safety equipment in industry.

More than 50 years have passed since the first hygienic standards in industrial hygiene were approved. The material accumulated in this time made it possible to substantiate and prepare a number of sanitary legislative documents and instructive-methodological material, which played a positive role in ameliorating working conditions and preventing occupational diseases. These documents include the All-Union SN 245-71, sanitary rules for organizing technological processes and hygienic requirements for industrial equipment, chapters in construction norms and regulations, norms for designing

heating systems, ventilation, air conditioning, natural and artificial lighting, etc.

At the present time, development of norm-related legislation has entered the most serious phase: state and All-Union standards are being set, which are included in the system of labor safety standards. In 1973-1978 alone, 30 standards were approved at the suggestion of the USSR Ministry of Health. In addition, 100 standards were approved that were developed by the USSR Ministry of Health in collaboration with industrial ministries and agencies. A unified system of labor safety standards is being developed for CEMA nations (four have already been approved). Standardization is a powerful lever for amelioration of working conditions, since it increases drastically the responsibility of planning organizations for adherence to hygienic requirements. Development of standards for the labor safety system must be expanded and virtually completed under the 11th Five-Year Plan. However, standards do not by any means replace other norm-related legislation, including sanitary rules. It is therefore not by chance that, at the present time, several unified sanitary rules (in ferrous and nonferrous metallurgy, coal, mineral, petrochemical branches of industry and others) are being prepared. But approval of unified sanitary rules does not rule out, on the contrary, it predetermines development of methodological instructions and recommendations, which clarify general theses and requirements of sanitary rules for different types of industry and technological processes. For this reason, the role of sectorial documents is increasing; they must be developed on the basis of the sanitary rules, with the consultant assistance of scientific research institutions.

It is only through the joint effort of science and practice that we can achieve orderly implementation of extensive ameliorative measures, further decline of occupational morbidity and successful fulfillment of all tasks set forth to public health agencies by the 25th CPSU Congress.
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CURRENT PROBLEMS OF PHARMACOTHERAPY OF OCCUPATIONAL POISONING

MOSCOW GIGIYENA TRUDA I PROFESSIONAL'NYYE ZABOLEVANIYA in Russian No 8, 1979
pp 5-8

[Article by S. I. Ashbel' (Gor'kiy), Institute of Industrial Hygiene and Occupational Diseases, submitted 31 Jul 78]

[Text] In view of the great strides made in the study of the pathogenesis of different occupational diseases and achievements in modern pharmacotherapy, there has been a significant increase in possibility of more successful treatment thereof.

New possibilities of pathogenetic therapy of poisoning appeared only after determining the great importance of effects of even infinitesimal concentrations of a number of substances (metals, cyanides, phosphorus, dinotrophenol and others) in blood and tissues on enzymatic systems of the body in the pathogenesis of poisoning induced by these agents (N. S. Pravdin et al.).

The most typical example of depression of enzyme activity by the direct interaction with enzymes of a toxic agent is referable to organophosphorus compounds (OPC), which inhibit cholinesterase--CE (N. A. Tolokontsev and V. A. Filov).

In the case of anticholinesterase action, a stable enzyme is formed, an inhibited complex, and there is accumulation of physiological acetylcholine with overexcitation of cholinergic structures, which is the basis of diverse manifestations of the toxic effect of OPC (M. Ya. Mikhel'son and E. L. Zeymal').

Determination of the mechanisms of toxic effect of OPC aided in development of antidotes, including CE reactivators (S. P. Golikov and S. D. Zaugol'nikov). Dipiroxime (Ye. A. Dudnikov and A. G. Pankov) and isonitrosin (G. K. Shein) are such reactivators; in combination with cholinolytics (atropine, aprophen and others) they were found highly effective in cases of OPC poisoning. At the present time, two new reactivators of phosphorylated CE, diethixim and dialkob (I. G. Misyukova and V. Ye. Petrun'kin) are undergoing clinical trials.

Studies have determined that the toxicity of many enzymatic poisons--compounds of arsenic, mercury, chromium, nickel, bismuth and other metals--depends on their effects on sulfhydryl (thiol) groups of cell proteins, as a result of which there is impairment of activity of the main enzymes, for the normal function of which free SH groups are required (Kh. S. Koshtoyants). This leads to metabolic disturbances, as well as changes in hormonal and immunobiological reactivity of protein.

It was subsequently found that dithiols capable of forming cyclic structures with the above-mentioned toxic agents, which are at least just as stable as compounds formed in interaction of enzyme poisons with enzymatic proteins, are effective antidotes in cases of such poisoning. As a result of a search for such products, Stokes and Thompson synthesized the chemical compound 2,3-dimercaptopropanon (dimercaprol), which was found to be highly effective in cases of arsenic and arsenic compound poisoning.

In the Soviet Union, a dithiol--unithiol--was synthesized, which is similar in chemical structure to dimercaprol (V. Ye. Petrun'kin). This product has a marked antidote effect in cases of poisoning by inorganic and organic mercury compounds, and it enhances elimination of these compounds from the body (S. I. Ashbel' and V. A. Tret'yakova; N. M. Kostygov, 1958; A. A. Model'; I. M. Trakhtenberg and G. I. Kulik, and others).

A marked antidote effect of unithiol was demonstrated in cases of poisoning by organic and inorganic arsenic compounds, as well as nickel compounds.

Succimer (dimercaptosuccinic acid), which was synthesized in 1959, was found to be a rather effective dithiol antidote, and it is used to treat mercury poisoning.

With regard to mechanism of action, dithiols are similar to complex-forming compounds (complexons, or chelates) capable of forming stable, undissociating complexes with many metals; they are readily dissolved in water and used as antidotes for poisoning by heavy metals and rare earth elements, to eliminate them from the body.

D-penicillamine (D-PAM), a penicillin derivative developed by Yu. P. Sazykin and S. M. Navashin at the All-Union Scientific Research Institute of Antibiotics, can be classified as a complexon. This product is an amino acid, dimethylcysteine. The presence in it of three active groups (sulfhydryl, carboxyl and amine) aids in its chelate formation with metals (Teisinger and Srbova, 1967; Werner and Weilman, 1966, and others). Experimental studies established that it has a marked antidote effect on mercury, copper, silver, lead, nickel, cadmium, zinc, cobalt, iron and manganese (Lehnert et al., 1970).

D-PAM was found effective in the treatment of poisoning by mercury fumes, inorganic and organic compounds thereof (S. I. Ashbel' et al., 1976).

According to the data of O. G. Arkhipova et al., unithiol has the strongest effect on elimination of mercury from the body, succimer and D-PAM are less effective.

The clinical studies of L. A. Zorina and N. S. Sorikina established the marked therapeutic effect of D-PAM in cases of occupational lead poisoning as well.

Derivatives of ethylene diaminetetraacetic acid (EDTA), tetacin-calcium (CaNa₂ EDTA) and pentacin (CaNa₂ DTPA) have found broad application as antidotes in cases of lead poisoning. The studies conducted by O. G. Arkhipova et al. revealed that pentacin is more effective than tetacin-calcium with regard to removal of lead from the body. These agents are used to accelerate elimination of incorporated ²¹⁰P and a number of rare earth elements. A. K. Gus'kova and G. D. Goyzogolov believe that pentacin is an etiotropic agent for elimination of these elements.

V. P. Borisov et al. observe that inhalation of pentacin aerosols has a high therapeutic effect on poisoning by plutonium, americium and other transuranium elements; this applies to phosphicin or pentaflacin for lesions due to uranium and beryllium, and inhalation of unlithiol or oxathiol in cases of poisoning by radioactive mercury.

Development of a chronic infectious and inflammatory process in the respiratory tract is a frequent complication of occupational poisoning, as well as other occupational diseases (conitogenic, allergic and other etiology). Since this process is often suppurative, it is notable for persistent course and frequent exacerbations, various antibiotics are used to treat it: penicillin, streptomycin, tetracycline group, levomycetin group, and others. These agents were the most effective when introduced in water-soluble form, directly into the respiratory tract as aerosols, using a laryngeal syringe or bronchoscope (S. I. Ashbel', 1962, 1971; E. A. Pokrovskaya), and particular when these techniques are combined with the usual methods of giving them to patients.

However, the therapeutic efficacy of antibiotics has diminished significantly, since pathogenic microflora has become resistant to most of them, the patients have developed allergization, as well as dysbacteriosis with most frequent activation of pathogenic staphylococcus and fungi of the genus *Candida*.

This made it necessary to use new antibacterial agents, that would be well tolerated by patients and have good antimicrobial properties when given in small doses, for the treatment of exacerbations of chronic infectious and inflammatory processes in patients with occupational lung disease. Such agents include the group of depot-sulfanilamides and derivatives of di-N-hydroxyquinoxaline.

It was established that long-acting sulfanilamides--sodium sulfapyradazine, sulfamenomethoxine, sulfadimethoxine (S. I. Ashbel' et al., 1966, 1970; S. I. Ashbel', 1974)--and ultralong-acting ones--orthosulfine and sulfalene (S. I. Ashbel' et al., 1977, 1977a)--are highly effective for acute infectious and inflammatory processes, as well as exacerbations of chronic nonspecific infectious and inflammatory processes in the bronchopulmonary system.

Quinoxaline derivatives, dioxidine and rhinoxidine, also elicit a marked therapeutic response in the presence of the above processes (S. I. Ashbel' et al., 1973).

A good therapeutic response is obtained with nystatin, levorin and amphotericin with development of occupational candidiasis induced by producer fungi or antibiotics. When this disease is localized in the respiratory tract, administration of water-soluble forms of the above products in the form of aerosol inhalations is particularly indicated.

Thus, great strides have been made in recent times in pharmacotherapy of a number of forms of occupational poisoning, infectious and inflammatory complications of these and other occupational diseases. However, vigorous work on etiologic and pathogenetic therapy of many other forms of occupational poisoning is still a very pressing problem of modern occupational pathology.

BIBLIOGRAPHY

1. Arkhipova, O. G.; Zorina, L. A.; and Sorkina, N. S. "Complexes in Symptomatology of Occupational Diseases," Moscow, 1975.
2. Ashbel', S. I. in "Novyye lekarstvennyye preparaty (Ekspress-informatsiya)" [New Drug Products (Express Information)], No 12, 1974, pp 24-32.
3. Ashbel', S. I.; Bogoslavskaya, I. A.; Sokolova, V. G.; et al. SOV. MED. [Soviet Medicine], No 3, 1973, pp 116-119.
4. Ashbel', S. I.; Bogoslavskaya, I. A.; Khil', R. G.; et al. KAZANSK. MED. ZH. [Kazan' Medical Journal], No 2, 1977, pp 20-23.
5. Ashbel', S. I.; Bogoslavskaya, I. A.; Spir'yanova, Ye. A.; et al. in "Voprosy gigiyeny truda, professional'noy patologii rabochikh khimicheskoy promyshlennosti" [Problems of Industrial Hygiene and Occupational Pathology Among Workers in the Chemical Industry], Moscow, 1977, pp 122-125.
6. Ashbel', S. I.; Bykova, I. P.; Dubkova, T. S.; et al. KLIN. MED. [Clinical Medicine], No 5, 1973, pp 80-83.
7. Ashbel', S. I.; Stroykova, G. D.; and Khil', R. G. GIG. TRUDA [Industrial Hygiene], No 3, 1976, pp 25-28.
8. Borisov, V. P.; Zhuravlev, V. F.; Ivanov, V. A.; et al. "First Aid for Acute Radiation Lesions," Moscow, 1976.
9. Golikov, S. N., and Zaugol'nikov, S. D. "Cholinesterase Reactivators," Leningrad, 1970.

10. Gus'kova, A. K., and Boysogolova, G. D. in "Luchevaya bolezni' cheloveka" [Radiation Sickness in Man], Moscow, 1971.
11. Dudnikov, Ye. A., and Pankov, A. G. KLIN. MED., No 7, 1969, p 134.
12. Koshtoyants, Kh. S. "Protein Bodies, Metabolism and Neural Regulation," Moscow, 1951.
13. Misyukova, I. G., and Petrun'kin, V. Ye. in "Vsesoyuznyy simpozium po klinike, diagnostike i lecheniyu zabolevaniy khimicheskoy etiologii. 2-y. Tezisy dokl." [Summaries of Papers Delivered at 2d All-Union Symposium on Symptomatology, Diagnostics and Treatment of Diseases of Chemical Etiology], Kiev, 1977, pp 87-88.
14. Mikhel'son, M. Ya., and Zeymal', E. V. "Acetylcholine," Leningrad, 1970.
15. Pokrovskaya, E. A. in "Vserossiyskoye soveshchaniye glavnykh khirurgov i terapevtov Minzdrava ASSR, kray- i oblzdravotdelov po voprosam pul'monologii. Materialy" [Proceedings of All-Russian Conference of Chief Surgeons and Internists of the Ministry of Health of Autonomous SSR, Kray and Oblast Health Departments Dealing With Pulmonology], Gor'kiy, 1971, pp 124-126.
16. Pravdin, N. S.; Il'ina, Z. A.; and Kremneva, S. I. in "Nauchnaya sessiya In-ta gigiyeny truda i professional'nykh zabolevaniy AMN SSSR. Tezisy dokladov" [Summaries of Papers Delivered at Scientific Session of the Institute of Industrial Hygiene and Occupational Diseases, USSR Academy of Medical Sciences], Moscow, 1951, pp 41-42.
17. Sazykin, Yu. P., and Navashin, S. M. ANTIBIOTIKI [Antibiotics], No 6, 1965, pp 362-372.
18. Tolokontsev, N. A., and V. A. Filova (editors) "Fundamentals of Industrial Toxicology," Leningrad, 1970.
19. Trakhtenberg, I. M., and Kulik, G. I. in "Gigiyena i toksikologiya novykh pestitsidov i klinika otravleniy" [Hygiene and Toxicology of New Pesticides and Symptomatology of Poisoning], Moscow, 1962, pp 451-458.
20. Shein, G. K., et al. FARMAKOL. I TOKSIKOL. [Pharmacology and Toxicology], No 4, 1968, p 490.
[612=10,657]

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FILTERS FOR COLLECTION OF CHEMICAL AEROSOL AND FUME SAMPLES FROM THE AIR

Moscow GIGIYENA TRUDA I PROFESSIONAL'NYYE ZABOLEVANIYA in Russian No 8, 1979
pp 52-54

[Article by S. I. Nurav'yeva, T. I. Solov'yeva, N. B. Borisov, L. I. Borisova and I. V. Petryanov (Moscow), Institute of Industrial Hygiene and Occupational Diseases, USSR Academy of Medical Sciences, and Physicochemical Institute, submitted 7 Jan 78]

[Text] Collection of samples of deleterious chemicals from air, which are present in it in both aerosol and gas forms, is one of the most important and rather difficult tasks in industrial sanitary analysis. The methods presently used to collect samples by means of absorbent solutions have several substantial flaws, which include, first of all, low efficacy in trapping chemicals, slow rate of aspiration, long duration of sample collection and cumbersome equipment. These flaws make it difficult to collect samples, particularly when assaying concentrations of toxic agents in the air environment that are below the permissible ones (MPC).

Our objective here was to develop new types of filters capable of both effectively trapping deleterious agents in air present in different aggregate forms at high rates of air pumping and with the least expenditure of time, as well as convenient and simple to use.

We used thin-fiber filtering material FP (Petryanov filter) and finely ground sorbent, which was added to the internal layers of the material, as the basis for producing such filters. We used various brands of activated carbon, ground KSK silica gel and NaX-13X zeolite as sorbents. The chosen sorbents have a large specific surface, they are chemically inactive and have high adsorption properties.

The main parameters characterizing the filters were sorbent content per unit filter surface, expressed in mg/cm², and aerodynamic resistance of the filter to the flow of air passing through it at a rate of 1 cm/s.

In developing the filters, we concentrated primarily on examining their sorption properties in trapping fumes of different chemicals under dynamic conditions. An experimental unit with dynamic dose dispenser, which provided

for a constant concentration of chemicals in the air environment, was assembled to conduct the studies. The Figure illustrates the scheme of this unit.

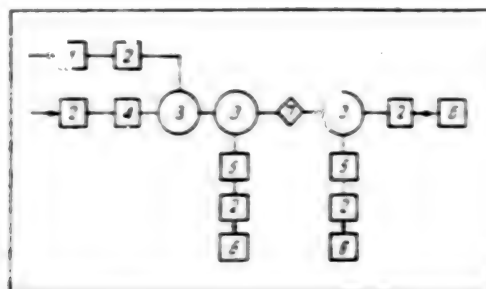


Diagram of unit for testing filter materials.

Explanation is given in the text.

Air entered dispenser 4, where it was saturated with fumes of the tested chemical to a constant concentration. Then the air containing a specific amount of the tested substance was mixed in glass mixer 3 with a flow of pure air, which was first passed through drying tube 1 filled with calcium chloride. The formed fume-air mixture passed from mixer 3 into cartridge 7 with the tested filter. The amount of chemical in the air-fume mixture before and after filtration was measured by collecting samples with absorbent units 5. The desired rate of flow of the fume-air mixture through the tested filter was established by means of electric aspirator 6, and it was monitored by rheometers 2.

The first studies were conducted with formic acid amides: formamide and dimethylformamide. The adsorption effect was evaluated according to time of passage of amides through the filter, i.e., "time of protective action," depending on sorbent content in the filter and rate of aspiration. The results of the tests are listed in Table 1, which shows that filters with 5-14.3 mg/cm² sorbent provide for virtually complete trapping of formic acid amides with initial concentrations thereof of 2.5-10 and 8-25 mg/m³ within 10-40 min at the rate of 8 cm/s. Filters with active carbon have the highest sorption capacity. With increase in aspiration rate, the "time of protective action" decreases, and only filters with 9 mg/cm² carbon can trap amides at the rate of 16 cm/s within 20 min. The mean dynamic capacity of the filters with carbon sorbent constitutes 0.005-0.02 mg formamide and 0.01-0.04 mg dimethylformamide per mg sorbent at a rate of 8 cm/s.

On the basis of the obtained results, in subsequent studies we used a filter with carbon OU-A as a sorbent. This filter was arbitrarily designated as AFAS-U.

The sorption properties of AFAS-U filters were tested with various volatile organic compounds used extensively in industry: aliphatic alcohols, carboxylic acids, aromatic compounds, amides of formic acid, aliphatic amines and acetates.

Table 1. Results of testing adsorption of formic acid amides by FP filters with finely ground sorbents

Substance	Subst. concentration, mg/m ³	Sorbent	Sorbent concentration, mg/cm ³	Time (min) of passage of substance through filter at	
				8 cm/s	16 cm/s
Formamide	2.5-10	Active carbon	5.0	10	<2
		"	9.0	40	20
		Silica gel	3.4	<5	<2
		"	7.8	20	5
		Zeolytes	7.6	<5	<2
Dimethylformamide	8-25	"	14.3	20	<2
		Active carbon	5.0	10	—
		"	9.0	40	20
		Silica gel	3.4	<5	<2
		"	7.8	20	<2
		Zeolytes	7.6	<5	<2
		"	14.3	10	<2

The tests were conducted with initial concentrations of fumes of organic substances that were 2-3 times higher than the MPC. The rate of air flow through the filters varied from 1.6 to 25 cm/s.

The results of testing the filters are listed in Table 2. In the last columns of this table are the found values of "time of protective action" and mean dynamic capacity of filters scaled to the unit of sorbent mass.

The obtained results indicate that AFAS-U filters with OU-A carbon in amounts of 8-10 mg/cm² have relatively high sorption capacity for the tested organic compounds, and they provide for complete trapping of fumes of most of them (with the exception of methyl alcohol, formic acid, acetates, benzene and aliphatic amines) in the presence of concentrations that are 2-4 times above the MPC, within 10-40 min, at rates of flow of up to 5-25 cm/s. One observes a distinct correlation between increase in adsorptivity of filters, increase in molecular mass and boiling point of the sorbed substance. The mean dynamic capacity of the filters is in the range of 0.007-0.06 g substance per gram OU-A carbon.

It should also be noted that, as shown by our tests, the filters are able to trap simultaneously aerosols of different degrees of dispersion. The effectiveness of trapping the most penetrating aerosol particles was at least 99% at a flow rate of up to 50 cm/s.

Aerodynamic resistance of AFAS-U filters containing 10 mg/cm² sorbent constituted 8-18 mm water at a flow rate of 1 cm/s. With increase in rate, there was linear increase in filter resistance.

Table 2. Results of testing AFAS-U filters

Substance	Initial concentration of fumes, mg/m ³	MPC, mg/m ³	Sorbent content in filter, mg/cm ²	Rate of sample collection, cm/s	"Protective" action time, min	Mean dynamic capacity per unit sorbent mass, g/g
Alcohols						
Methyl	15-20	3-4	8	1,6	<2	<0.005
Propyl	15-20	1,5-2	8	8	20	} 0.007
			8	16	10	
Butyl	20	2	8	8	20	} 0.025
			8	16	10	
Amyl	20	2	8	8	20	} 0.04
			8	16	10	
			8	25	10	} 0.05
Hexyl	20	2,5	8	8	35	
			8	16	20	} 0.05
			8	25	10	
Carboxylic acids						
Formic	10-15		10	8	<2	<0.001
Acetic	10-15	2-3	10	8	20	0.015
Propionic	10-15		10	8	30	} 0.018
			10	16	10	
Butyric	10-15	1-1,5	10	8	40	} 0.03
			10	16	20	
			10	25	10	} 0.05
Hexylic	10-15	2-3	10	8	40	
			10	16	30	} 0.05
			10	25	30	
Acetates						
Ethylacetate	400	2	9,8	5	<10	<0.12
Propylacetate	400	2	9,8	5	<10	<0.12
Butylacetate	400	2	9,8	5	<10	<0.12
Formic acid amides						
Formamide	6	2	10	8	46	} 0.014
			10	16	23	
N-methylformamide	15-20		10	8	40	} 0.035
			10	16	20	
N,N-dimethylformamide	30	3	10	8	40	} 0.06
			10	16	20	
Aliphatic amines						
Diethylamine	10		9,8	8	<10	<0.005
Triethylamine	10	1	9,8	8	<10	<0.005
Aromatic compounds						
Benzene	10	2	10	1,6	<10	<0.001
Toluene	150-200	3-4	10	5	10	~0.05
o-Xylene	150-200	3-4	10	8	10	~0.08

In addition to testing the filters, much attention was given to development of methods of removing adsorbed substances from the filters and quantitative assay thereof.

Carboxylic acids and formic acid amides are totally extracted by washing the filters in hot distilled water. The optimum prerequisite for extraction is to treat twice, in 5 ml water, filters with a working surface of 10 cm².

A technique was developed for alcohol extraction involving complete dissolution of the fibrous base of the filter in toluene or xylene, followed by allowing the solution to stand for settling of the carbon suspension. When this method is used, extraction of alcohols from the filters constituted 98-100%.

The amount of substances extracted from the filters was assayed in solutions using conventional methods of analysis.

Thus, these studies revealed that filters based on FP filtering material and finely ground OU-A carbon can be used for simultaneous trapping of aerosols and fumes of some organic compounds, for the purpose of assaying their levels in the air environment in the presence of concentrations exceeding the MPC by 2-4 times.

BIBLIOGRAPHY

1. Peregud, Ye. A. "Chemical Analysis of Air," Moscow, 1976.
2. Petryanov, I. V.; Kozlov, V. I.; Basmanov, P. I.; et al. "Fibrous FP Filtering Materials," Moscow, 1968.
[612-10,657]

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ASSAY OF TOLUYLENE DIISOCYANATE AND 4,4'-DIPHENYLMETHANE DIISOCYANATE IN AIR

Moscow GIGIYENA TRUDA I PROFESSIONAL'NYYE ZABOLEVANIYA in Russian No 8, 1979
pp 55-56

[Article by T. G. Lipina, A. Ya. Tubina and L. V. Kunilova (Gor'kiy),
Institute of Industrial Hygiene and Occupational Diseases, submitted 26 Jun 77]

[Text] The air of work rooms where toluylene diisocyanate (TDI) is produced is polluted with fumes of TDI, chlorogenzene, phosgene, ammonia, toluylene diamine (TDA) and Dowtherm, whereas that of rooms where polyisocyanates are produced is polluted with fumes and aerosol of 4,4'-diphenylmethane diamine (MDA) and MDI [diphenylmethane diisocyanate], fumes of phosgene, chlorobenzene, ammonia and Dowtherm.

The methods we propose are based on quantitative hydrolysis of TDI and MDI to TDA and MDA, respectively, which are condensed with p-dimethylaminobenzaldehyde with formation of substances that color the solution yellow. This reaction has found application for assaying other aromatic amines in air (N. G. Andreyeshchevs; L. T. Kurenko).

To solutions containing 0.5-10 g substance in 2 ml 40% acetic acid, we add 2 ml 2% p-dimethylaminobenzaldehyde in the same acetic acid. The yellow solution, which can be preserved for 6 h, is submitted to photometry after 10-15 min at 432-450 nm in a 10-mm cuvette. The initial TDI solution is prepared in dry acetone and diluted in 40% acetic acid to concentrations of 100 and 10 µg/ml, and the indicated series of solutions is produced under the same conditions.

MDI solutions containing 0.25-20 µg in 2 ml 40% acetic acid are heated for 2 min in a boiling water bath. After cooling, we add 2 ml 2% p-dimethylaminobenzaldehyde and complete analysis as indicated above. The molar coefficient of light absorption is $96,000 \pm 300$, with reading error of 20-3% (n = 6). Standard solutions are prepared in the same way as TDI solutions.

The range of demonstration (in mg/m³) and error factor of the reading are established upon absorption of the air-fume mixture of TDI by a compound reagent. The air-fume mixture was prepared using a dispenser [of doses] based on diffusion of fumes from acetone solutions (A. A. Nazarenko et al.).

Up to 20 l dry air was bubbled through the dispenser containing 0.5 ml acetone solution of TDI. The fumes were trapped in serially connected Zaytsev absorbers each containing 4 ml 1% p-dimethylaminobenzaldehyde in 40% acetic acid. The rate of aspiration constituted 0.3-0.4 l/min. In the presence of TDI fumes, the solution turns yellow. The dispenser was washed in 1% p-dimethylaminobenzaldehyde in 40% acetic acid containing 1 drop of concentrated sulfuric acid in order to convert substances formed under the influence of moisture on TDI into an amine. The washings were analyzed by the above-described method.

On the basis of the results of 8 tests, it was established that TDI fumes of the order of 0.025-7 mg/m³ with mean error of 5-10% are demonstrable by the recommended method.

In determining the range of detection and error of determination of MDI fumes, the fume-gas mixture was produced in the following manner: To a U-shaped tube (inside diameter 4 mm and height 2.5 cm) containing 0.1 ml MDI solution in dry acetone, we connected an absorber with 4 ml 1% solution of p-dimethylaminobenzaldehyde in 40% acetic acid. The tube was heated over an electric heating plate to 90-110° and concurrently we aspirated the dry air at a rate of 0.3-0.4 l/min. We added 0.1 ml concentrated sulfuric acid into the tube and heated it for 5 min in a boiling water bath; the residue of substance was washed off with 1% p-dimethylaminobenzaldehyde. The solutions in the absorbers and washings were analyzed by the above-described method. According to the results of 5 tests, the recommended method assays concentrations of MDI of the order of 0.04-13 mg/m³ with mean error of 15%.

Chlorobenzene, phosgene, ammonia and Dowtherm fumes do not hinder assays of TDI and MDI. TDA and MDA yield the same reaction.

To assay diisocyanates in the presence of the corresponding diamines, two parallel samples are collected at the same time. For overall assays of TDA and TDI fumes, up to 20 l of air is aspirated at the rate of 0.3-0.4 l/min through the Zaytsev absorber containing 4 ml 1% p-dimethylaminobenzaldehyde in 40% acetic acid.

If it is necessary to make an overall assay of fumes and aerosol of MDI and MDA, 10 l air are pulled through the cartridge with an AFA-V-10 filter and Zaytsev absorber with 4 ml 1% p-dimethylaminobenzaldehyde; the filter is filled with 4 ml 1% p-dimethylaminobenzaldehyde in 40% acetic acid. The solution from absorbers and washings from the filter are analyzed as described above.

Diamines are selectively assayed in the second sample.

Up to 20 l air for assay of TDA and 10 l for assay of MDA is pulled through the cartridge with an AFA-V-10 filter and Zaytsev absorber with 4 ml 1% ammonia. To 4 ml fluid from the absorber and washings from the filter we add 3 ml glacial acetic acid and 1 ml 5% p-dimethylaminobenzaldehyde in glacial acetic

acid. The samples are submitted to photometry after 10-15 min at 432-540 nm in a 20-mm cuvette. Comparisons are made according to calibration graphs prepared under the above-mentioned conditions for MDA and TDA: in 40% acetic acid for MDA in the range of 0.25-10 μ g, and in the range of 0.5-10 μ g for TDA.

The recommended methods have been tested under industrial conditions in the production of TDI and polyisocyanates. The demonstrated concentrations of fumes in the work zone reflected the distinctions of the production operations and were in the ranges of 0.025-0.7 mg/m^3 (TDI) and 0.025-1.74 mg/m^3 (MDI).

Conclusions

1. A method was developed for assaying 4,4'-diphenylmethane diisocyanate in air according to the reaction of condensation with p-dimethylaminobenzaldehyde in an acetic acid medium. The sensitivity of readings is 0.25 μ g in 4 ml solution. Minimum assayable concentration is 0.04 mg/m^3 . Chlorobenzene, phosgene, ammonia and Dowtherm fumes do not hinder the readings.
2. A method was developed for assaying toluylene diisocyanate according to the condensation reaction with p-dimethylaminobenzaldehyde in acetic acid. The minimum demonstrable concentration is 0.025 mg/m^3 . Chlorobenzene, phosgene, ammonia and Dowtherm fumes do not hinder the readings.
3. Conditions were found for separate assays of 4,4'-diphenylmethane diisocyanate and toluylene diisocyanate, and the corresponding amines.

BIBLIOGRAPHY

1. Andreyeshcheva, N. G. GIG. I SAN. [Hygiene and Sanitation], No 12, 1968, pp 102-104; No 6, 1969, p 99; No 10, 1969, p 110.
2. Nazarenko, A. A., et al. in "Sostoyaniye i perspektivy razvitiya analiticheskogo priborostroyeniya do 1975" [Status and Prospects of Development of Analytical Instrument Making up to 1975], Tula, 1975, pp 64-67.
3. Simonov, V. A.; Nekhorosheva, Ye. V.; and Zavorovskaya, N. A. GIG. I SAN., No 6, 1975, pp 100-103.
4. Tubina, A. Ya. in "Voprosy gigiyeny i okhrany truda, promyshlennoy toksikologii i profpatologii v proizvodstve syr'ya i sinteticheskikh smol, kauchuka i plastmassy" [Problems of Industrial Hygiene and Safety, Industrial Toxicology and Occupational Pathology in the Production of Raw Materials and Synthetic Resins, Rubber and Plastics], Gor'kiy, 1973, pp 51-52.

5. Tubina, A. Ya. in "Opredeleniye vrednykh veshchestv v vozdukh proizvodstvennykh pomeshcheniy" [Assaying Deleterious Substances in the Air of Industrial Buildings], edited by A. A. Belyakov and Ye. Sh. Gronsberg, Gor'kiy, 1970, pp 220-222.
6. Pilz, W. MICROCHIM. ICHNOANALYT. ACTA, Vol 4, 1965, pp 687-698.
7. Reilly, D. A. ANALYST, Vol 92, 1967, pp 513-519.
[612-10,657]

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USE OF CONTINUOUS COULOMETRIC METHOD FOR ASSAYING ORGANOCHLORINE COMPOUNDS UNDER INDUSTRIAL CONDITIONS

Moscow GIGIYENA TRUDA I PROFESSIONAL'NYYE ZABOLEVANIYA in Russian No 8, 1979 pp 56-58

[Article by I. I. Rasputnis (Leningrad), Institute of Industrial Hygiene and Occupational Diseases, submitted 26 Dec 77]

[Text] The high toxicity of a number of organochlorine compounds, which are gaining increasing use in industry, makes it necessary to implement constant sanitary supervision of the condition of the air environment in industrial buildings where they are used.

The concentrations of organochlorine compounds that are released into the air during various technological operations vary in time, so that for proper hygienic evaluation of a plant one must know the dynamics of changes therein, and this is feasible only if there is a method of continuous assay of such substances in air.

The coulometric principle is the most suitable for development of portable gas analyzers; it makes it possible to obtain light-weight, portable and highly sensitive instruments (N. Sh. Vol'berg, 1969). Use of a method based on combustion of chlorinated hydrocarbons on a platinum catalyst at 700-800°C, oxidation of formed hydrogen chloride with potassium bromate and coulometric assay of free chlorine (N. Sh. Vol'berg, 1971) is the most reliable and easily produced variant of the coulometric method. However, the above method encountered two problems in practical use: lack of criterion for refining an anode of porous silver, which diminishes the reliability of cell operation, and lack of possibility of adjusting the zero line on the instrument.

To assay simple chlorine, we used a cell developed for determination of iodine (N. Sh. Vol'berg and I. I. Pochina). The anode and cathode were made of a platinum grid. A solution containing 25% lithium chloride and 5% cadmium iodide served as electrolyte. The cell operates with applied external voltage of 0.38 V, with a very low background current (0.17 μ A), which determines great sensitivity of analysis. The free chlorine entering the coulometric cell forces out the iodine from cadmium iodide, which is

reduced [or restored] on the cell cathode. The simple iodine released at the anode is absorbed by a layer of AV-17 anion-exchange resin placed at the bottom of the anode chamber.

The obtained data were used as the basis for manufacturing a working portable coulometric unit for assaying chlorinated hydrocarbons, and a diagram thereof is illustrated in Figure 1. The unit operates in the following manner: the organochlorine compound contained in analyzed air, after passing through purifier cartridge one, enters a quartz tube containing 0.1 ml catalyst 2, and at 700-800°C it is burned to hydrogen chloride, which then enters tube 4 containing 0.2 ml oxidant. The free chlorine formed as a result of this reaction, upon entering coulometric cell 5 with the flow of air forces out the iodine which enters into the electrode reaction. The current generated in the coulometric cell is recorded with microammeter 10, which has a low input resistance. The gas-air mixture is aspirated into the unit by means of microcompressor 7, and the rate of air flow is regulated by rheometer 6. The background current is compensated with potentiometer R; that is connected to battery B₂.

Air that had already passed through the system was used to adjust the zero position. For this purpose, the input and output of the unit were connected to one another by means of three-way valve 9. To avoid excessive wetting of the oxidant, the air was dried in special column 8.

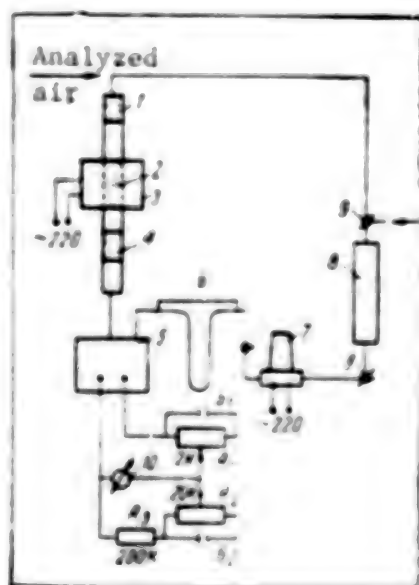


Figure 1.
Diagram of portable unit for assay
of chlorinated hydrocarbons
3) heater
B₁, B₂) elements 373
R₁, R₂) resistances
Other designations are explained
in the text



Figure 2.
Course of changes in concentration
of vinyl chloride in mixing depart-
ment, in the extrusion method of
manufacturing linoleum

To check the flow yield according to substance (dichloroethane, trichloroethylene, methylene chloride) with a diffusion dispenser with optical measurement of substance debit (N. Sh. Vol'berg, 1969), we added a precisely known microflow of the tested substances to the flow of air aspirated into the unit. It was established that the yield of current [flow] constituted $87.4 \pm 1.22\%$ of the theoretical value ($n = 11$, $\alpha = 0.95$) for dichloroethane, $83.5 \pm 3.37\%$ ($n = 16$, $\alpha = 0.95$) for methylene chloride and $80.4 \pm 5.63\%$ for trichloroethylene ($n = 9$, $\alpha = 0.95$).

Thus, the current yield constitutes a mean of $84 \pm 3.4\%$ for the organochlorine compounds we studied, and this can be considered quite satisfactory.

Good reproducibility of current yield when measuring different concentrations of compounds at different times caused us to consider it feasible to add a correction coefficient.

With delivery of analyzed air at the rate of 100 ml/min and use of a recording microammeter with a scale of 0-5 μA , this portable unit has a sensitivity of the order of 0.5 mg/m³ and drift of 10-12 min.

In principle, the method can be considered a group one for assaying chlorine in organochloride compounds (with the exception of perchlorinated ones).

The developed instrument was used for hygienic assays in a number of industries using chlorinated hydrocarbons. We determined the vinyl chloride, trichloroethylene, dichloroethane and methylene chloride levels in the air environment of several plants. For the sake of convenience of reading on the microammeter scale, the graduation of the latter was adjusted to changes in delivery of analyzed air, in such a manner as to have 1 μA correspond to 1 mg/m³ concentration of the analyzed compound. The following rates of delivery of the air-gas mixture were set: 30.7 ml/min for dichloroethane, 26.4 ml/min for methylene chloride, 27.2 ml/min for trichloroethylene and 39.8 ml/min for vinyl chloride. We considered the current yield separately.

The portable unit was first calibrated for each compound (with the exception of vinyl chloride, because of the difficulty of dosing it, and for it we adopted a mean current yield of 84%). The accuracy of calibration of the portable unit was checked with each compound to be analyzed, before and after taking readings at the plant. In the case of vinyl chloride, the unit was checked for dichloroethane. The sensitivity of the unit, i.e., current yield for the compound assayed, did not change in the course of 3-4 days of intensive use.

The levels of chlorinated hydrocarbons released into the air environment during the relevant technological processes were measured every 3-5 min at each of the tested work places in the course of several complete work cycles.

Hygienic evaluation of the polyvinyl chloride linoleum industry was made for two methods of manufacture thereof: extrusion and rolling-calendering.

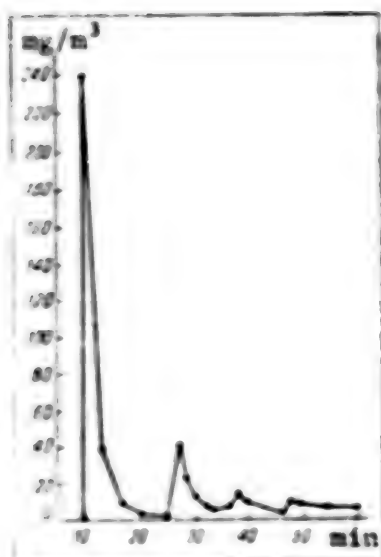


Figure 3.
Change in concentration of trichloroethylene during automatic washing of radio parts

to levels exceeding the MPC at the time the jars with the parts are lifted from the tubs. For example, in the case of semiautomatic washing the peak reaches 110 mg/m^3 and with automatic washing it is 238 mg/m^3 (MPC = 10 mg/m^3).

Analogous studies were made of the air environment for levels of dichloroethane fumes in the production of lacquer-film capacitors and methylene chloride, which is discharged into the air when washing electrical equipment.

Thus, the portable, continuous action unit was used to conduct hygienic tests of pollution of work zones by different chlorinated hydrocarbons, and as a result marked fluctuations of concentrations were found in all plants examined, with peaks reaching considerable levels.

One to four days were required to inspect each enterprise. As a result, about 50 analyses were made for trichloroethylene content of air, 150 for vinyl chloride, 100 for methylene chloride and 500 for dichloroethane. To obtain just as comprehensive information using, for example, the well-known lamp method, would have required 130-160 working days.

The high sensitivity of the method, lack of need for preliminary collection of a gas sample made it possible to determine the concentration of a microimpurity directly at the work place, with little time lag (of the order of 10-12 min).

Use of the continuous method of assaying vinyl chloride established that in the production of polyvinyl chloride linoleum there are frequent changes in concentration of vinyl chloride exceeding the MPC [maximum permissible concentration] by several times (Figure 2). As a result of the studies, it was found that there is less discharge of vinyl chloride into the air environment with the production of linoleum by the extrusion method than by the rolling-calendering method. The concentrations of vinyl chloride were below the MPC in all areas, with the exception of the mixing department.

A study of pollution of the air environment of industrial buildings by trichloroethylene in washing radio parts (Figure 3) revealed that there is a drastic increase in concentration of trichloroethylene in air

This unit made it possible to record all changes in concentration of the compounds under study, and this is particularly important for technological processes associated with brief discharge of toxic microimpurities. It is virtually impossible to detect them by conventional methods with preliminary collection of an air sample, since because of the low sensitivity of these methods and the need to accumulate the required amount of the compound in question in the sample one has to collect large volumes of the gas-air mixture over a long period of time, and this results in considerable averaging of concentration in time.

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DISPENSARY SERVICE TO SHIPS' CREW MEMBERS WITH REGARD TO ISCHEMIC HEART DISEASE

Moscow SOVETSKOYE ZDRAVOOKHRANENIYE in Russian No 8, 1979 signed to press 16 Jan 79 pp 20-23

[Article by L. I. Aleynikova and I. I. Saltykov, Odessa Medical Institute, Basin Hospital on Water Transport (chief physician -- candidate of medical sciences A. A. Lobenko), Odessa]

[Text] Diseases of the cardiovascular system (including ischemic heart disease--IBS) occupy one of the leading positions in the structure of the incidence of disease among ships' crew members and comprise from 19 to 47 percent of all cases of chronic diseases (L. I. Aleynikova et al; M. I. Mikhaylova and O. N. Gorback; R. Tomashevski and Ya. Khmelevski), which requires further study of this pathology and development of measures on qualitative improvement of the dispensary service system to ships' crew members.

According to treatment data and the results of annual medical examinations of ships' crew members, the distribution of IBS and its specific weight in the structure of the chronic pathology of therapeutic profile was studied over a period of 3 years (1975-1977).

The distribution of IBS comprised 31.3 ± 1.6 per 1,000 seamen during 3 years and peptic and duodenal ulcers, which occupy second place in the incidence of disease, were encountered almost one-third as much (11.8 ± 0.6). The tendency toward an increase of the distribution of IBS is noted in this case. Thus, in 1977 the incidence comprised 35.9 ± 1.7 per 1,000 seamen, while in 1975 and 1976 it comprised 29.6 ± 1.0 and 28.0 ± 0.9 ($F = 0.05$), respectively. The specific weight of IBS in the structure of cardiovascular pathology was also the highest and comprised an average of 53.9 percent over 3 years.

An analysis which we carried out showed that diseases of the cardiovascular system most frequently prevent crew members from working on maritime vessels. Thus, an average of 12.3 percent of seamen were prevented from sailing over 3 years with diseases of the circulatory organs and for 34.0 percent of them their range of navigation was limited (including 45.2 and 56.9 percent of seamen, respectively, with regard to IBS).

It should be noted that permission of seamen suffering from IBS, including personnel who have had myocardial infarct to work on ships became possible after dispensary observation of the crew members during the voyage was introduced into practice in 1973. We observed patients with IBS, personnel threatened with respect to IBS and essentially healthy seamen. The use of a complex of measures on primary and secondary prevention of IBS made it possible to achieve a zero incidence of temporary loss of work capacity with regard to aggravation of IBS during a 4-year period of dispensary observation during the voyage.

The complexity and responsibility of physician and labor expertise of crew members may lead to hyperdiagnosis, especially in personnel of middle and old age. In this regard it becomes necessary to improve methods of expert analysis of the work capacity of seamen with diseases of the circulatory organs, to which introduction of objective diagnostic methods into practice contributes.

Along with generally accepted methods of investigation, we used the loading test (veloergometry) in 44 seamen, including 92 with IBS. The results of the investigation showed that no symptoms of coronary insufficiency were determined in part of the patients (31.5 percent) when performing submaximal loading. One can calculate maximum oxygen consumption and energy expenditures from the indicators of the loading test (N. M. Amosov and Ya. A. Bendet). The results can be compared to data available in the literature on the energy expenditures of seamen during labor activity.

The energy expenditures of most seamen when performing occupational duties are comparatively low. The individual energy expenditures were higher than the maximum energy consumption of these specialists during the watch than those indicated in the literature (L. M. Shafran et al) among ship navigators which we examined, including those with IBS. Only four members of the engine-room team (among 36 machinists and fitters engaged in the watch examined) had permissible energy expenditures that were below the maximum required to perform their occupational duties, with regard to which lightened work conditions were recommended for these personnel. Thus, the use of quantitative criteria of evaluating the state of health of seamen suffering with IBS permits the use of these data for efficient labor organization.

The results of examination using load tests and laboratory methods of investigation were presented to the medical expert analysis committee of the crew members which, on the basis of our conclusions, changed or refined the decision to permit seamen to sail. For example, the region of navigation was expanded for 14 of 92 patients with IBS examined, the period of recertification by a therapist was refined in 11 cases and 7 of 10 seamen temporarily removed due to the disease were permitted to work on ships. This was of socioeconomic significance both for the seamen and for the shipping company.

When analyzing the preliminary medical documents of the polyclinic and dispensary, it was determined that 142 seamen with IBS were sent for hospital

examination during the 3 years (1975-1977). According to the existing situation, these personnel were sent to the hospital for refinement of the diagnosis. The diagnosis established in the polyclinic was not changed in half of the indicated personnel. If one takes into account that the same volume of investigations can be carried out in the polyclinic of ships' crew members as in the hospital, it becomes understandable that examination of the group of seamen indicated above could be carried out under ambulatory conditions, which yields a specific economic effect.

The complexity of the tasks of medical and labor expertise and efficient labor arrangement and also the necessity of a differentiated approach to implementation of therapeutic and preventive measures during the voyage and periods between the voyage with respect to patients with IBS and personnel among the risk group led us to conclude a need to develop recommendations to improve their dispensary service.

All seamen were distributed into five groups for this purpose: the first group was healthy, the second group was personnel threatened by IBS, the third group was patients with IBS having initial clinical manifestations or latent course of the disease, the fourth group was patients with IBS in the presence of atherosclerotic cardiosclerosis and with satisfactory functional state of the cardiovascular system and the fifth group was patients with IBS having marked atherosclerotic (postinfarct) cardiosclerosis.

It should be emphasized that three main problems are faced by polyclinic physicians during the period between voyages. Two of them include medical and labor expert analysis of the state of health of seamen and analysis of their suitability for working on maritime vessels; the third no less significant problem is to fulfill therapeutic and treatment measures and preparation of recommendations for ship medical workers. In our opinion, the results of electrocardiographic examination using the step test or veloergometry should play a decisive role in analyzing the functional state of the cardiovascular system and in conducting expert analysis of the work capacity of seamen suffering from IBS.

Patients of the third and fourth groups can be permitted to work on long-range ships with favorable course of the disease, absence of clinical and electrocardiograph symptoms of coronary insufficiency when performing the load test and good indicators of physical work capacity with repeat recertification within 6 months. Patients of the fifth group are removed from navigation and are temporarily assigned to shore duty (watch duty, duty officer and tackle duty) on ships at moorings and individual treatment and physical rehabilitation lasting not less than 3 months are assigned for them. They return to duty after a second examination using functional load tests. The navigation region for these personnel is expanded in stages with regard to analysis of the state of their health and work capacity by the ship's doctor.

The periods and navigation region are established for each group during medical and labor expert analysis of crew members during the period between

voyages and additional examinations are recommended, for example, patients of the third and fourth groups must undergo examination of the coagulogram indices and cholesteroline and β -lipoprotein content in the blood, an electrocardiographic examination using the load test is administered and the main therapeutic and preventive measures--diet therapy, prescription of hypolipidemic substances, vasodilating preparations, vitamin complexes and so on--are fulfilled; exercise programs and physical therapy treatment using on-shore prophylactic institutions (for example, the intervoyage rest base for seamen) for this are recommended to the patients.

The ship doctors should devote special attention to nutritional balance, eliminating a deficit of motor activity and control of smoking in providing dispensary service to seamen with IBS. Physical culture exercises are carried out according to recommendations received after training exercises by physical rehabilitation programs conducted at the intervoyage rest base. Medicinal treatment is carried out according to the instructions of department therapists. Patients with IBS are released from heavy types of labor (for example, sailors and fitters are transferred from the working brigade to the watch) upon coordination with the ship administration.

The results of dispensary service to personnel suffering with IBS or those related to the risk group were evaluated by the state of their health and work capacity. Prolonged dispensary observation of them during the voyage and during the period between voyages confirmed the effectiveness of the proposed measures; there were no cases of temporary work incapacity with regard to the main disease and the patients retained the required occupational activity.

The new approach to dispensary service to seamen with IBS and those among the risk group permit qualitative improvement of expert analysis of work capacity, efficient work organization of these workers and also contributes to more effective implementation of therapeutic and preventive measures both during the voyage and the period between voyages.

BIBLIOGRAPHY

1. Aleynikova, L.I., M.S. Denisyuk, Z. F. Zhebokritskaya et al, in "Aktualnye voprosy zdravookhraneniya na vodnom transporte" [Timely Problems of Health on Water Transport], Kiev, 1970.
2. Amosov, N. M. and Ya. A. Bendet, "Fizicheskaya aktivnost' i serdtse" [Physical Activity and the Heart], Kiev, 1975.
3. Mikhaylova, M.I. and O. N. Gorbach, BULL. INST. MARINE MED. GDANSK, Nos 2, 3 and 4, 1974.
4. Roytman, M..P., L. L. Lunskaya and L. V. Setyukova, SOV. ZDRAVOOKHR., No 9, 1968.

5. Tomashevski, R. and Ya. Khmelevski, in "Mezhdunarodnyy simpozium po morskoy meditsine, 7-y, Materialy" [Proceedings of the Seventh International Symposium on Marine Medicine], Moscow, 1976.
6. Shafran, L. M., G. Ye. Palatnik and V. I. Vigovskiy, GIG. I SAN., No 12, 1975.
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CHANGES IN ACID-BASE BALANCE AND BLOOD OXYGEN PRESSURE IN POISONING BY ORGANOPHOSPHORUS COMPOUNDS

Kiev VRACHEBNOYE DELO in Russian No 6, 1979 pp 98-101

[Article by Prof. Ye. V. Gembitskiy, Doctor of Medical Sciences I. M. Markelov and T. I. Mitrofanova, Military Medical Academy imeni S. M. Kirov, Leningrad]

[Text] The purpose of this work was to clarify disturbances in acid-base balance, to evaluate changes in pO_2 during injury to the respiratory apparatus and to correct the disturbances found. Acid-base balance (ABB) was measured by the Astrup method, pressure of oxygen of arterial and venous blood was assayed with a "Kombianalizator" polarograph. Under observation were 60 people (16 with a mild degree of poisoning, 22 with a moderate degree, and 22 with a severe and extremely severe degree (classification of Ye. V. Gembitskiy et al. 1970).

Clinical manifestation of acute respiratory insufficiency (ARI) was not seen during poisoning of a mild degree. The majority with poisoning of average severity noticed difficulty in breathing, more often of exhalation, a sense of shortage of air. The number of characteristic, objective symptoms of intoxication also included acrocyanosis of various degrees of expression, rapid breathing up to 22-32 breaths per minute, superficial breathing with involvement of auxiliary musculature, a large number of whistling and buzzing, dry rales.

The manifestation of respiratory disturbances during poisoning of a severe degree was different: pronounced cyanosis, rapid breathing up to 40-50 breaths per minute, superficial respiration, unequal in depth; on auscultation, respiration is hard with slowed exhalation and a large number of dry and varied-caliber moist rales. In 13 people, the respiratory disturbances were so pronounced that they required carrying out artificial ventilation of the lungs (AVL). In five of these patients, against a background of a comatose state and a pronounced picture of intoxication, central paralysis of breathing developed. The observed complication was accompanied by manifestation of severe, arrhythmic (unequal in depth) fading breathing and accumulation of signs of hypoxemia, in connection with which, in addition

to antidote therapy, these patients--in the prehospitalized stage--were administered AVL through an intubation tube; the AVL was continued in the hospital. After several hours three patients recovered independent breathing, while two had added paralysis of the respiratory musculature on the second day. In the other eight patients, on the second to third day of intoxication, peripheral paralysis of breathing developed. Patients of this group complained of insufficiency of air, difficulty of inhalation, pronounced muscular weakness; they had increasing cyanosis and rapid breathing. In this connection, they were placed on AVL for an extended time (up to 8 days); six of the patients got AVL through an intubation tube and four, in the first two days, underwent a tracheostomy which made it possible to better synchronize the patients with the apparatus, to sanitize the tracheobronchial tree and it simplified care over them.

Patients with a mild degree of poisoning displayed less pronounced disturbance in ABB, as was to be expected. Changes of ABB in 10 of 16 people in this group did not appear in individual patients, only compensated metabolic acidosis was encountered. At the same time, 10 patients displayed a decrease in oxygenation of the arterial blood (pO_2 76.7 ± 5.6 mm Hg, $P < 0.01$) and an increase of arterial-venous difference with respect to oxygen. All this indicates primary disturbance of function of external respiration, leading to development of respiratory hypoxia. Normalization of pathological indices in patients of this group, against a background of antidote therapy, appeared in the course of three days.

In poisoning of average severity, changes were more pronounced: in 9 of the 22 patients, compensated metabolic acidosis appeared, in 2 uncompensated metabolic acidosis, and in 2 uncompensated metabolic alkalosis (pH 7.81; BE + 7.8, pCO_2 39 mm Hg; pH 7.54; BE +3.1; pCO_2 25 mm Hg). In 14 patients substantial disturbances of oxygenation of arterial blood occurred. (pO_2 58.20 ± 3.36 ; $P < 0.01$) the arterial-venous difference with respect to oxygen rose sharply, the pCO_2 decreased. Normalization of indices appeared on the fifth to seventh day, as the result of administration of antidotes and alkaline solutions.

For the group of patients with a severe degree of poisoning (22 people), substantial disturbances of ABB with sharp uncompensated shifts towards metabolic acidosis were characteristic. In 5 of these patients, similar pathological shifts were observed against a background of applied artificial ventilation of the lungs which can be explained by an accompanying collapsed condition. Arterial hypoxemia was noted in practically all of the patients, whereby, in individual cases, there was lowering of pO_2 of the arteries to 32 mm Hg.

As an illustration, let us describe one history of the illness:

Patient M., male, 38, entered the Leningrad Center for Treatment of Acute Poisonings on 9 Sep 1976 at 0 hr 30 min, 2.5 hours after intake (in an alcoholic drunken state) of 100 ml karbofos. In the pre-hospital stage

catheter washing of the stomach was carried out, 10.0 0.1% solution of atropine and 300 mg diproxim were administered intravenously. On presentation, condition severe, consciousness jumbled, severe miosis, spontaneous myofibrillations, hyperhidrosis, multiple vomitings, diarrhea. Pulse 92 per minute, rhythmic, arterial pressure 100/60 mm Hg. Breathing 26 per min. Over the lungs, percutaneously a pulmonary sound, on auscultation, disseminated dry rales, moderate number of small and medium bubbly rales. Blood on presentation: P 16%, S. 72% L. 11%, M. 1%, BSR 14 mm per hr., hem. 14%, er. 5200000, leuk. 11750. Toxic myopathia, generalized form.

10 Sep 1976 at 9 hr: pH 7.22, BE 11.8 meq/l, pCO₂ 34.5 mm Hg; paO₂ 50 mm Hg; pvO₂ 36 mm Hg. At the end of the first day there began to accumulate symptoms of acute respiratory insufficiency, associated with developing paralysis of the respiratory muscles. At 9 hr 30 min the patient was placed on an AVL apparatus RO-3, a mixture of air and oxygen was given through an intubation tube. After a day of supplying AVL, the pH was 7.35; BE + 3.0 meq/l; pCO₂ 34.5 mm Hg; paO₂ 50 mm Hg; pvO₂ 36 mm Hg. In connection with the need for prolonged AVC, a tracheostomy was executed on the second day through which AVL was continued for seven days without interruption. Control analysis of blood on the fourth day: pH 7.40; BE + 3.5 meq/l; pCO₂ 40.5 mm Hg; paO₂ 75 mm Hg, pvO₂ 50 mm Hg.

During the stay of the patient in the hospital, the patient received active antidote therapy with 0.1% solution of atropine (first day 44.0 ml, second 22.0 ml; third 21.0 ml). Total dose of atropine for the eight days was 122.0 ml 0.1% solution. In the first two days, forced diuresis was performed, alkalies were administered. In the course of the last two days, the patient was periodically removed from the AVL apparatus and he breathed spontaneously. 18 Sep 1976 independent breathing was fully restored (pH 7.40; BE 0.8 meq/l; pCO₂ 37.5 mm Hg; paO₂ 79 mm Hg; pvO₂ 40 mm Hg).

It must be noted that the course of the intoxication was complicated by development of toxic myocardiodystrophy with symptoms of cardiac insufficiency on the first two days, bilateral pneumonia, on account of which he received corresponding therapy.

Therefore, it appears that in the patient with severe degree of poisoning with an organophosphorus compound, paralysis of the respiratory musculature developed, leading to appearance of respiratory insufficiency with pronounced arterial hypoxemia and an ABB shift to metabolic acidosis.

As the result of the therapy applied, the metabolic disturbances were compensated by administration of alkaline solutions. Artificial ventilation of the lungs did not immediately assure good oxygenation which can be explained by the circulatory disturbances in connection with the developing myocardial dystrophy and disturbance of transmembrane diffusion of oxygen into the alveoli, following an inflammatory process in the lungs. Subsequently, normalization of metabolic and respiratory disturbances set in. The patient was released in satisfactory condition.

The data obtained are in some conflict with the position that, in the acute stage, disturbances of ventilation due to bronchospasm and bronchorrhoea dominate. In all probability, the cited conflict is explained by the circumstance that intake of blood was achieved after administration of substantial doses of beta-cholinolytics, diluting the obstructive disturbances. Serving as support for this could be data obtained in the mild forms of poisoning, when, against a background of minimal ventilation disturbances, forms of compensated metabolic acidoses are encountered. Probably, its development is immediately connected with a decrease in oxygen pressure in the blood. What speaks for this is the greater--greater than under physiological conditions--arterial-venous difference with respect to oxygen which is immediately connected with appearance of restrictive disorders and, in some degree, with disturbance of nervous regulation of the ratio of ventilation and circulation in the individual sectors of the lungs. Considering all the laboratory indices, development of tissue hypoxia also cannot be totally excluded in the patients--an immediate inhibition of oxidizing enzymes by the organophosphorus compounds. For full confirmation of this additional studies are necessary.

As a result of the studies completed, patterns of disturbance of ABB and pO_2 are revealed. The obtained data indicate that these disturbances are a function of the degree of severity and period of intoxication. At their foundation are pathogenetic mechanisms the basis of which appear to be: in poisonings of average severity, in addition, there is disturbance of neural regulation of the relationship of ventilation and circulation in the individual sectors of the lungs, and also, probably, of the diffusion of gases through the alveolar-capillary membrane; in poisonings of a severe degree, development of central and peripheral paralysis of breathing, possibly an essential disturbance of diffusion due to development of early pneumonia, appear at the first stage. In poisoning by organophosphorous compounds, one cannot completely exclude development of tissue hypoxia due to direct inhibition of oxidative enzymes.

All of this stipulates a need for a differentiated approach to questions of the therapy applied.

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CLINICAL-MATHEMATICAL ANALYSIS OF THE SPECIFIC FEATURES OF PSYCHOPATHOLOGICAL SYMPTOMS SUFFERED BY DEAF PATIENTS

Moscow SOVETSKAYA MEDITSINA in Russian No 7, 1979 pp 104-106

[Article by V. F. Matveyev, K. G. Dzugayev, L. M. Bardenshteyn, and B. A. Kobrinskiy, Depart of Psychiatry, Moscow Medical Stomatological Institute imeni N. A. Semashko]

[Text] Dynamic clinical examination of mature deaf patients (laborers, tekhnikum students) has revealed a number of psychopathological symptoms of neurotic and pathocharacterological order fitting within the framework of the modern concept of pathological personality development. These disturbances were represented by a combination of asthenic and autonomic disorders, and sensitive and exaggerated constructs associated with a sense of personal deficiency. Various hypochondriachal experiences independent of the dominant pathocharacterological syndrome were noted rather often in the clinical pattern. Examined patients were uniquely "sensitized" to repetitive, even insignificant psychogenic influences, which hindered their social adaptation. Such "sensitization" often led to decompensation.

This decompensation was often accompanied by various perception disturbances taking the form of cenesthopathy and affective visual illusions (the latter were noted exclusively at night and in the evening). At the peak of such experiences, sensitive ideas of (otnosheniye) often transformed into exaggerated ideas. However, the acute period of pathological experiences was short-lasting, and it disappeared as the mentally traumatic situation disappeared. Subsequently, following many years of illness, psychopathological disturbances became chronic, merging with the personality structure of these patients. Psychopathological symptoms were characterized by pronounced polymorphism, monotony, and psychological mosaicism.

In addition to the principal pathocharacterological syndrome (excitability, inhibition), facultative psychopathological traits were broadly represented in the clinical pattern. We distinguished the following groups of patients in our clinical analysis: 1--patients suffering psychopathy of the excitable type, with explosive traits dominating; 2--patients with psychopathy of the inhibitory type (asthenic and obsessive-hypochondriachal

variants); 3--patients suffering pathological development (asthenic-depressive and excitable variants); 4--control group.

This brief list of the principal mental disorders encountered among the studied patients is based not only on a meticulous clinical analysis. To achieve the objectives of our research, we also subjected extensive psychopathological data describing the patients to statistical analysis. Writing the program for mathematic treatment of the clinical material, we selected 80 of the most frequently encountered clinical characteristics. The program was written in FORTRAN-IV for a BSM-6 computer.

The characteristics were binary, each of them assuming one of two values (0 or 1), which corresponded to presence or absence of a particular sign: 0 meant normal for the given characteristic, and 1 meant a deviation from normal.

The program contained two principal subprograms. The first was used to determine those characteristics which were common to each of the isolated groups of patients; the numbers of these characteristics were printed out, and the frequency with which each of the 80 characteristics was encountered was indicated.

Results issued on the basis of this subprogram by an automatic digital printing device made it possible to distinguish, in addition to symptoms common to each group (disturbance of overall state, sleep disorders, and hypochondria), the most significant symptoms in each of the clinical groups described by us. Thus a propensity for tumultuous affect coupled with a predisposition toward violent actions were the most significant symptoms in relation to psychopathy of the excitable type with explosive traits dominating. The asthenic syndrome complex was most typical of asthenic psychopathy. In addition to grotesquely pronounced hypochondria, fluctuations in mood leaning in the direction of depression and phobias were typical of the obsessive-hypochondriachal variant of psychopathy. Depressive symptoms, to include signs of adynamia and sluggishness in the morning and a pronounced asthenic component in the evening, manifested themselves most distinctly in the presence of the asthenic-depressive variant of pathological personality development. Excessive irritability, often coupled with explosiveness and unmotivated mood fluctuations, usually with a tendency toward depression, and a higher propensity for hysterical reactions, were typical of the excitable variant of pathological personality development. Subjects in the control group did not exhibit pronounced psychopathological disturbances.

The second subprogram permitted us to distinguish so-called dominant characteristics--that is, those differing from common characteristics by not more than the statistical error, which was equal to $....\sqrt{...K}$, where K is the number of patients in the group. The basis for this is that the probability that each characteristic would be present in the group has a Poisson distribution.

In addition to those described above, we revealed the following dominant symptoms among patients diagnosed to be suffering psychopathies of the excitable type with explosive traits dominating: A propensity for tumultuous affect going as far as fits of rage and aggressiveness in response to inconsequential stimuli, irritability, capriciousness, captiousness, maliciousness, unmotivated mood fluctuations, a feeling of personal deficiency, suspiciousness, unsociability, egoism, and exactingness towards surrounding individuals.

Dominant symptoms accompanying psychopathy of the asthenic type included a feeling of discomfort, irritability, reduced activity, emotional lability, a feeling of personal deficiency, and suspiciousness. Indecisiveness, an inhibited, melancholy mood, and a feeling of personal deficiency were typical of the obsessive-hypochondriachal variant of psychopathy.

Patients with the asthenic-depressive variant of pathological personality development were typified by fast tiring, hypodynamia, the emotional disturbances described above, indecisiveness, a certain degree of introversion, and a tendency to avoid additional loads in the family and at work. Greater sensitivity, touchiness, melodramatic responses, captiousness, verbosity, exaggerated self-assessment, and maliciousness were noted among patients with the excitable variant of pathological personality development on the background of pronounced autonomic-vascular disturbances.

Dominant symptoms were not established for persons in the control group.

It should be noted that the dynamic clinical method is still the principal one, permitting us to precisely differentiate among different psychopathological symptoms. As an example mathematical analysis did reveal presence of a number of similar symptoms among patients suffering psychopathies characterized by the obsessive-hypochondriachal and asthenic-depressive variants of pathological personality development, but clinical observation also revealed dominance, in the group of patients with inhibitory types of psychopathies, pronounced autonomic-vascular components that not only paint a unique picture of decompensation but also significantly define the clinical uniqueness of this variant.

Hypochondriachal traits were typical of practically all examined patients. Mathematical analysis does not reveal the causes of this uniqueness in the clinical pattern of the mental disturbances; however, considering the features of higher nervous activity experienced by deaf people due to sensory deprivation, we can hypothesize that relative dominance of interoceptive impulses (in comparison with healthy people) is at the basis of the frequency with which hypochondriachal disturbances are observed in patients of all groups.

Using the common and dominant characteristics distinguished in our work, we could make a tentative vector diagnosis for a concrete patient, demonstrating him to be suffering one particular group of psychopathological states or another.

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SOURCES OF KAL'MIUS RIVER POLLUTION IN DONETSK

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pp 65-67

[Article by Ye. A. Radoshkevich, N. V. Grin', and V. I. Solov'yev (Donetsk City Sanitation and Epidemiological Station): "Storm, Melt, and Street Sprinkling and Washing Water as a Main Factor in Kal'mius River Pollution within the Limits of Donetsk"]

[Text] One of the most serious hygienic problems of present times is the sanitary protection of reservoirs from pollution and the complete elimination of the dumping in them of raw and insufficiently purified waste water.

Much work to protect reservoirs from pollution by waste water is being done in Donetsk in carrying out the decrees of the CPSU Central Committee and Council of Ministers in recent years ("Measures to Further Improve the Protection of Nature and Efficient Utilization of Natural Resources," 1972, "Measures to Avert Pollution of Basins of the Black and Azov Seas," 1976, and others). During the period 1971-1977, 19 million rubles, which made it possible to put into operation 88 installations to treat production and storm waste waters, was expended by the city's industrial and motor transport enterprises and organizations in the construction of water protection projects. Of the total number of installations built and renovated 37 are operating by using purified waste waters which have been recycled, thus freeing 440,000 cubic meters of fresh water a day. As a result of the putting into operation of 51 installations for treating production and storm waste waters the dumping into open reservoirs of 24,000 cubic meters a day has been discontinued and 158,500 cubic meters of waste water a day is being purified based on sanitation norms. By introducing recycled water systems and constructing treatment facilities the dumping of raw industrial waste water into reservoirs has been curtailed from 30,000 cubic meters a day (1970) to 600 cubic meters a day (1977), and the amount of insufficiently treated waste water has been reduced from 136,000 cubic meters a day (1971) to 62,200 cubic meters a day (1977).

It would seem that the taking of such measures for the sanitary protection of the Kal'mius River which flows through Donetsk from north to south

should have led to a significant improvement in water quality there. However, in the 10-year period the content in the water of ammonium nitrate decreased only from 23.0 ± 4.1 to 13.0 ± 2.6 mg/l, while the BOD_5 decreased from 86.1 ± 9.6 to 30.0 ± 5.2 mg/l; recently these indicators have remained at almost the same level. In our opinion at the present time the water quality of the Kal'nus River is basically determined by incoming storm, melt, and street sprinkling and washing water from the territory of Donetsk.

Thus, according to data of the Leningrad Scientific Research Institute of the Academy of Municipal Services imeni K. D. Pamfilov for the years 1963-1964 and 1969-1974 (M. V. Molokov and V. N. Shifrin), the Minsk Central Scientific Research Institute of Comprehensive Research on Water Resources for 1964-1973 (M. V. Molokov and V. N. Shifrin), and the All-Union Scientific Research Institute for Water Protection in Khar'kov for the period 1962-1974 (M. V. Molokov and V. N. Shifrin), storm water from the territory of the cities contains from 470 to 3,000 mg/l of suspensions and from 10 to 100 mg/l of petroleum products and has a BOD_5 from 25 to 150 mg/l. It has been established by associates of these institutes that the storm water from the vicinity of industrial-motor transport enterprises is still polluting to a great degree. It should be noted that SNiP II-93-74 "Enterprises for Motor Vehicle Servicing"¹ officially established the composition of pollutants for these enterprises: 300 mg/l of suspended matter, 7.5 to 90 mg/l of petroleum products, and 40 mg/l for BOD_5 . Analogous indicators are also provided in "Temporary Instructions for the Planning of Facilities for Purifying Surface Waste Water" Σ 496.77.² It was shown by the work of collectives of the institutes named that the rate of oxidation of organic substances in surface drainage is somewhat lower than in domestic waste water. Full BOD for storm drainage reaches hygienic norms only after 25 to 30 days. In the storm water 25 percent of the suspensions are organic substances. Since it frequently rains at intervals of 20 days or less, it is understood that the reservoir is not able to purify itself during this time and therefore stagnates and becomes overgrown with blue-green algae. Speaking about purely specific pollution by storm drainage from industrial areas, one must keep in mind that surface-active substances, cyanides, rhodanines, phenols, ammonium nitrate, and so forth enter the reservoirs with them.

In 1977 the Donetsk Affiliate of the All-Union Scientific Research and Design Institute Chermetenergoochistka conducted a study of the make-up of storm drainage from industrial areas of three metallurgical plants in Donetskaya Oblast. It was established here that the amount of suspended particles in the drainage ranged from 220 to 3,300 mg/l, petroleum products ranged from 10.5 to 136.0 mg/l, and the chemical O_2 minimum from 31 to 410 mg/l; cyanides were observed in concentrations up to 0.5 mg/l. In 1976 and 1977 laboratories of the Donetsk City Sanitation and Epidemiological Station and the Donetsk City Sanitation and Epidemiological Station and the Donetsk

1. Moscow, Stroyizdat, 1975.

2. Ibid., 1978.

Chemical Plant did research on the surface drainage from the area of the chemical plant. Results of the analysis showed that this drainage contains from 231 to 2,232 mg/l of suspended particle, 28 to 794 mg/l of petroleum products, and from 0.098 to 2.98 mg/l of sulfanol. Up to 1.0 mg/l of cyanides and 0.5 mg/l of phenols were observed in storm water from the by-product coke plant, along with a large amount of petroleum products and suspensions. The data cited bear witness to the fact that surface drainage is the main factor in Kal'mius River pollution in Donetsk. However, it should be pointed out that in solving problems of purifying storm drainage both from the territory of housing construction and highways and from industrial sites state sanitation inspection agencies encounter great difficulties. The fact is that sanitation-epidemiological stations do not have at their disposal data about the composition of rain drainage from a large number of industries. This question is not even answered in "Temporary Instructions for the Planning of Facilities for Purifying Surface Waste Water" SN 496-77. The problem of purifying storm waters is not being treated sufficiently seriously by planning organizations. For example, of 56 projects reviewed by the Donetsk City Sanitation and Epidemiological Station in 1977, 30 were declined because of failure to resolve problems of purifying storm drainage. Planning organizations quite frequently tend to locate model projects without producing an estimate of the amount of rain water according to SNiP II-32-74; the result is that the planned facilities are not able to guarantee the purifying of the storm waters. Moreover, problems in utilization of purified storm drainage to supplement irrevocable losses in recycling systems are to all intents and purposes not being solved by planning organizations.

The following is an example of the lack of a serious attitude toward this source of water pollution. The Khar'kov Giprostal' issued a letter of guarantee without data on the qualitative make-up of storm drainage about the fact that there will be no petroleum products on the new site of the Donetsk Metallurgical Plant and consequently a petroleum catcher is not needed. At the same time it is known that if the drafting organization does not have at its disposal data on the qualitative make-up of the drainage, it is necessary first to conduct scientific research and then on the recommendations of the institute to plan treatment facilities. State sanitation inspection agencies are not finding the necessary support even among municipal service organs, in particular the city department of municipal services. Often, when the sanitation and epidemiological station requires purification of storm drainage from industrial enterprises, regulations are not being carried out because of an absence of arterial rain collectors in which the dumping of wastes would have been possible. The problem of purifying surface drainage from housing and highways is not being completely solved. The city department of municipal services is not even using existing rain collectors; of the 170 km of rain collectors in the city a total of 32 km are present on the balance sheet.

However, in spite of the difficulties in the matter of protecting reservoirs from pollution by surface water, there have still been definite achievements in this phase of our work. For example, there are under the control of the

city sanitation and epidemiological station 30 laboratories for research on industrial waste waters which have the obligation to conduct laboratory studies of storm drainage no less than three times a month during the period of precipitation and to forward the data obtained to the city and appropriate rayon sanitation and epidemiological stations.

An arterial collector which diverts storm drainage from the Nizhne-Kal'mius reservoir has been built in the city at our insistence.

We are demanding the obligatory purification of storm drainage and are reviewing plan documents in coordinating plans for measures to protect reservoirs this year. As a result of our purposeful efforts in 1977 the city built five facilities to purify storm drainage and 46 more are planned for 1978.

In collaboration with the Donetsk Affiliate of the Ukrziprokommunistroy Institute, we calculated the incoming storm drainage from industrial sites of motor transport and other enterprises servicing motor vehicles using the requirements of SNiP II-32-74; this will make it possible to review in a more skilled manner the plans in the section for sanitary protection of reservoirs from pollution by storm drainage. The results of the work in the area of Donetsk reservoir protection enabled us to make the following proposals at the Republic Conference-Seminar on this question held in Svetlovodsk, Kirovogradskaya Oblast, 22 to 25 May 1978: the scientific research institutes of the Ukrainian Ministry of Health should conduct appropriate studies of the characteristics of the qualitative make-up of storm drainage discharged from the territory of industrial enterprises and centers of population and present the results of the studies in the form of recommendations on purifying storm drainage and preventing their effect on the sanitary conditions of reservoirs and should ask Ukrainian Gosstroy to make it mandatory for planning institutes to guarantee the purifying of storm drainage before it is discharged into public reservoirs.

BIBLIOGRAPHY

1. Molokov, M. V. and Shifrin, V. N. "Ochistka poverkhnostnogo stoka s territorii gorodov i promyshlennyykh ploshchadok" [Purification of Surface Run-off from the Territory of Cities and Industrial Sites], Moscow, 1977.

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EFFORTS TO AVERT POLLUTION OF MOSCOW WATER SUPPLY

Moscow GIGIYENA I SANITARIYA in Russian No 8, 1979 submitted 28 Nov 78 pp 63-67

[Article by S. V. Semenov and A. K. Chergetyko (Republic Sanitation-Epidemiological Station of the RSFSR Ministry of Health, Moscow, and the Moscow Basin Sanitation-Epidemiological Station): "New Rules for Ships and Shore Installations in the Sanitary Protection Zone of Moscow Water Supply Sources"]

[Text] Problems of averting pollution of bodies of water in the Upper Volga Basin by river transport -- ships as well as shore installations and facilities servicing them -- are very important in the problem of protecting Moscow water supply sources. The development of water management in Moscow is inseparably connected with the expansion of the Moscow Water Transport Center. The starting up of the Navigation Canal imeni Moskva 40 years ago and its active active utilization made it possible by 1978 to bring the proportion of river shipping to 30 percent of the total volume of Moscow freight turnover (compared to 4 percent in 1937). At the same time the canal is an open stream through which water enters from the Ivankovskiy reservoir into the city's centralized water supply system. For the first time the sanitation and hygiene requirements for protecting the Moscow water supply sources from contamination by river transport were defined in the Sanitation Rules for Ships and Shore Installations Within the Sanitary Protection Zone of the Canal imeni Moskva which were approved in 1949.

In the past 30 years there have been significant changes in the city's water management and sanitation and hygiene requirements for the quality of drinking water and for ships as a source of basin pollution. In this connection it has become necessary to develop new rules for ships and shore installations located in the sanitary protection zone of Moscow water supply sources. The rules were approved by the USSR Ministry of Health and the USSR Ministry of Reclamation and Water Management on 16 August 1978.

The problem of protecting bodies of water from pollution by river ships and shore installations which service them is being solved by outfitting ships with systems which make it possible to accumulate sewage, garbage, and

other wastes on board ship and also by constructing shore installations and floating facilities for receiving everyday-domestic sewage and garbage from the ships and floating stations for collecting and purifying oil-containing bilge water and ballast waters, waste oils, and wastes from freight being transported.

Comprehensive measures carried out in recent years in the Upper Volga Basin to avert reservoir pollution by ships created prerequisites for broadening the range of extension of sanitation-hygiene requirements and the boundaries of reservoirs in which these requirements should be effective. Thus, the requirements established by the new rules must be met not only by ships in the river fleet, but also by individual enterprises and organizations of various ministries and departments located in the jurisdiction, river ports and railroad stations, piers, ship repair and shipbuilding yards, hydraulic engineering installations, sedimentation centers, bunker bases and other facilities which service ships. The rules are in effect within boundaries which include reservoirs on practically the entire territory of the drainage basin of the Ivan'kovskiy reservoir, the Canal imeni Moskva, its reservoir, and the Moscow River.

The rules prohibit within the established boundaries of the reservoirs the dumping from ships and shore installations of unpurified waste water, bilge and ballast water, residues of freight which has been transported, garbage and other refuse, and also designate places of anchorage for small ships. They introduce a limitation on navigation areas for small ships in private use and also the requirement of mandatory equipping of ships depending on their type and designation with devices which preclude the possibility of the purposeful pollution of the reservoirs and reduce to the minimum the chance of accidental dumping. The transporting of petroleum products is permitted only on ships especially intended for this purpose. In view of the continuous increase in the volume of loading and unloading operations at river ports and the expansion of the extraction of minerals from the bottoms of reservoirs, as well as dredging and hydraulic engineering operations in the Upper Volga Basin the rules point out the need to implement measures to avert the pollution of bodies of water during the carrying out of the processes indicated and measures to localize and eliminate the consequences of pollution which results from accidents.

A number of clauses in the rules are aimed at increasing to the maximum the responsibility of ship management for reservoir pollution. For example, the management within whose jurisdiction the facilities for collecting and purifying waste waters from ships are located is charged with the functions of sealing the connecting pipes for free discharge into sewage-disposal, bilge and drainage systems on ships, and institutions of the sanitation and epidemiological service and organs for regulating water use and protection are charged with control over the carrying out of these duties by management. The navigation of ships within the established boundaries is permitted only with closed and sealed sluice valves in the ships' systems.

The organizations and departments, ships and shore installations which operate in the sanitary protection zone of Moscow water supply sources are responsible for guaranteeing the systematic cleaning up of the surface and ice of reservoirs of pollution by their wood pulp, garbage, and petroleum products.

Thus, the clauses and demands of the new rules for ships and shore installations located in the sanitary protection zone of the Moscow water supply sources reflect the present-day approach to solving problems of maximum improvement of the sanitation condition of reservoirs in the Upper Volga Basin being used for domestic-drinking and cultural and household needs of the people of Moscow and other centers of population located along the shore.

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OCCURRENCE OF BOTULISM CAUSED BY HOME PRESERVES

Kiev VRACHEBNOYE DELO in Russian No 6, 1979 pp 111-114

[Article by L. I. Bogachik, M. A. Andreychin, N. A. Zogachik and N. A. Vasil'yeva, Department of Infectious Diseases, Ternopol' Medical Institute]

[Text] Botulism disease is encountered relatively infrequently but, in recent years, publications have appeared on cases of botulism in which products of home canning served as the basic factors of transmission of infection. (I. S. Vartanyants, 1972; V. N. Mel'nikov, N. I. Mel'nikov, 1973; V. M. Lyubimov, 1973; R. F. Sokol, 1977).

In the present work we have analyzed the clinical picture of botulism, placing special attention on the questions of early diagnosis of the disease and the cause of diagnostic errors.

In recent years the clinic has treated 78 botulism patients, age of the patients from 4 to 68 (72 adults and 6 children). Twenty seven were women, 51 men. A mild form was diagnosed in 19 people, average severity in 38 and severe in 21.

Analysis indicated that only eight of the patients were hospitalized in the course of the first three days from onset of the disease, 44 at the end of the first week, the rest in the second or third week. The late hospitalization of the majority of the patients can be explained in that, as a result of mistaken diagnoses the patients were, for a long time, under the observation of physicians of other specialties. In connection with the disturbance of vision almost half of the sick initially turned to physician-oculists, who prescribed glasses for some patients. The other patients were treated by an internist, neuropathologist, toxicologist, chest physician and oncologist. In addition to ophthalmological pathology, as a preliminary diagnosis there were found food-toxico-infection, acute gastroenteritis, poison by pesticides, cancer of the esophagus and pulmonary tuberculosis. Withall, in the majority of patients under attentive interrogation and objective examination, diagnosis of botulism did not present substantial difficulties. From the epidemiological anamnesis it appeared that the basic factors of transmission of the disease were home-prepared marinated mushrooms (12), sausages (11), vegetable and fish preserves (8) laid in store.

Group diseases from botulism took place only in ten foci, from two to five cases in each.

Duration of the incubation period amounted to from several hours to five days. The disease began gradually or sub-acutely with general weakness and dizziness, more rarely with head ache, nausea, one or two vomitings and short-term diarrhea. In the course of one to three days there was observed a sub-febrile temperature which disappeared with the development of neurological symptoms characteristic of botulism. Then the clinical picture was dominated by an ophthalmic syndrome which was diagnosed in practically all patients. Noted among the subjective symptoms was a drop in visual acuity, sensation of a "fog" or "screen" before the eyes (95%), diplopia (64.1%). Found on examination were mydriasis (68%), disturbance of convergence and accommodation (54%), ptosis (38.5%), rather often bilateral, a sluggish reaction of the pupils to light, anisocoria (35.9%), strabismus (12.8%) and nystagmus (1.3%).

It must be noted the expression of the ophthalmoneurological syndrome in the patients varied--from illegible symptoms to development of every range of visual disturbances. The most difficult to diagnose were cases with individual signs of disturbance of eye-motoric nerves which required differential diagnosis from cancer or hemorrhage in the brain, stem encephalitis, poisoning due to methyl alcohol or atropine.

Disturbance of vision and the basic syndrome of this disease have been reported by K. V. Bunin, S. G. Pak (1969), V. A. Postovit, G. S. Vasil'yeva (1975), and I. N. Zhuk, T. M. Zubik (1976). According to data of Zh. A. Pebenok (1968), ophthalmoplegia can be another individual sign of botulism.

All patients complained of the sensation of thirst, dryness in the mouth and nasal passages. In 43 of the patients swallowing of solid foods was more difficult. Noted less often was entry of water and liquid food into the nose and choking (14.1%). Almost half of the patients had pain in the epigastrium, disturbance of appetite and constipation. Noted on examination was a decrease in salivation, coating of the tongue with a thick white or yellow deposit, hyperemia of the nasopharynx and meteorism. Paralysis of the soft palate was diagnosed in 6.3%.

Simultaneously with disturbance of the digestive system there developed a disturbance of the vocal apparatus: from hoarsening of the voice (42.3%) and nasalizing of speech (10.3%) right up to aphonia (2.5%). Cases of the disease accompanied by symptoms of disturbances of nuclei of the IX and XI pairs of craniocerebral nerves created substantial difficulties in differential diagnosis from diphtheria, poliomyelitis and encephalitis of other etiology.

Syndromes of respiratory disturbances and muscular paresis were encountered rarely. Thus, six people had dyspnea and two, disturbance of the muscles of the neck and extremities.

Moderate disturbance of the cardiovascular system in the form of tachycardia and muffling of the heart tones was observed only with a severe course of the disease.

The hemogram was characterized by a normal number of leukocytes: in 20.5% of the patients eosinophilia was noted, lymphocytosis in 35.9%.

Diagnosis was confirmed in 34 cases with a positive biological sample (in 33, there was found botulin toxin type B and in one, type A) and in two cases, epidemiologically (the patients were from a focus of laboratory confirmed botulinism).

The use of combined treatment with indispensable inclusion of antitoxin serum gave the possibility of achieving complete recovery. There were no deaths.

As illustrations let us present extracts from the histories of the disease:

1. Patient M., male 32, entered the clinic on the fifth day of illness with complaints of a "fog" and double vision, difficulty in swallowing, nausea, dryness in the mouth, headache, general weakness, retention of stool. He fell ill 19 Apr 1976 when he first noted disturbances of vision and a single vomiting. Two days before the illness he ate ham prepared at home; of eight persons who consumed the same food, five became sick, all had similar symptoms. Noted in the hospital were ptosis, mydriasis, anisocoria, paresis of convergence and accommodation, nystagmus, dysphagia. Tongue dry, swallowing difficult. Tones of the heart weakened, pulse 88 per minute, arterial pressure 120/70 mm Hg. Abdomen swollen. Blood and urine without peculiarities. In completion of a biological test, toxin of botulism type B was discovered. Therapy was carried out: single administration of polyvalent antitoxin serum (25000 IU), penicillin, cardiac agents, 5% glucose with 0.85% solution of sodium chloride intravenously, dropwise, vitamins of B group, syphon enemas. Released as recovered on the 23rd day of illness.

2. Patient B., female, 56, entered the clinic on the eighth day of illness with complaints of multiple vomiting and constipation. Ill since 13 May when she noticed a sharp headache, dizziness, general weakness. After a day there appeared chill, pain in the epigastrium, then a liquid stool, cramps of the muscles of the lower extremities. From 17 May, weakening of vision, disturbance in swallowing, severe thirst.

In the day before illness she ate home-made preserved meat stew.

On examination in the hospital, condition poor; bilateral ptosis, more expressed on the right; mydriasis, anisocoria, converging cross-eyes. Sharply weakened convergence and accommodation, sluggish reaction of pupils to light. Dryness of the tongue and nasal membrane. Swallowing of solid food difficult, tongue reflex decreased. Voice hoarse, speech nasalized with nasal swelling. Somewhat animated tendon reflexes. Position in bed strained, hands held at edge of the bed since in this position it is easier to breathe. On account of disturbance in equilibrium, difficulty in walking. Rigidity of occipital muscles, 4 cm. Breathing weakened, heart tones

muffled, arterial pressure 95/70 mm Hg. In the blood, insignificant leukocytosis (9200), urine, nothing unusual. In connection with suspicion of meningoencephalitis lumbar puncture was made: in 1 mm³ fluid, 7 cells, protein 0.37 0/00, Pandy reaction ++. With the help of a biological test in mice, presence of botulotoxin type B was revealed. Concluding diagnosis, botulism B, severe course. Patient observed bed regimen, she obtained polyvalent antitoxin serum (25000 IU), penicillin, biotycin, B group vitamins, cardiac and detoxifying agents. Noted in the dynamics was a gradual disappearance of clinical symptoms. Retained longest of all was dryness in the mouth and the "fog" before the eyes—up to the 30th day of the disease. Released as recovered on the 37th day of illness.

Therefore, correct evaluation of neurological symptoms and epidemiological data makes it possible to promptly diagnose botulism and to prescribe specific therapy. Acute disturbance of vision without apparent cause for it requires purposeful precision of the epidemiological anamnesis, and clarification of a question of consumption of preserved food products.

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PUBLIC HEALTH

UKASE ON HEALTH-CARE CHANGES, ADDITIONS TO FUNDAMENTALS OF LEGISLATION

Moscow VEDOMOSTI VERKHOVNOGO SOVETA SSSR in Russian No 25 (1995), 20 Jun 79
pp 540-541

[Ukase No 438 of the Presidium of the USSR Supreme Soviet on Insertion of Changes and Additions into the Fundamentals of Legislation of the USSR and Union Republics on Health Care]

[Excerpt] The Presidium of the USSR Supreme Soviet decrees:

1. For the purpose of bringing into accord with the USSR Constitution and for the further improvement of legislation on health care, the insertion of the following changes and additions into the Fundamentals of Legislation of the USSR and union republics on health care approved by USSR Law of 19 December 1969 (VEDOMOSTI VERKHOVNOGO SOVETA SSSR, No 52, 1969, p 466):

1. Articles 3 and 4 to be set forth in the following wording:

"Article 3. The Right of Citizens to Protection of Health

In accordance with the USSR Constitution, USSR citizens have the right to protection of health.

This right is provided for through free skilled medical assistance rendered by state health-care institutions; expansion of the network of institutions for treatment and strengthening of citizens' health; development and improvement of labor safety techniques and production sanitation; implementation of wide-scale preventive measures; measures for making the environment healthier; special concern for the health of the rising generation, including prohibition of child labor not connected with education or labor training; expansion of scientific research aimed at the prevention and reduction of morbidity and at ensuring a long active life for citizens.

Article 4. Protection of the Health of the Population--an Obligation of All State Organs and Public Organizations

Protection of the health of the population is the duty of all state organs, enterprises and organizations. The plenary powers of the mentioned organs,

enterprises, institutions and organizations for protection of the health of the population are determined by legislation of the USSR and union republics.

Trade unions, cooperative organizations, the Red Cross and Red Crescent societies and other public organizations in accordance with their charters (statutes) take part in ensuring protection of the health of the population in a manner provided by legislation of the USSR and union republics.

USSR citizens must exercise care in regard to their health and the health of other members of society."

2. Clauses three and seven of Article 5 to be set forth in the following wording:

"(3) implementation of measures for making the environment healthier, ensuring of sanitary protection of water bodies, soil and atmospheric air;"

"(7) expansion of the network of sanatorium-health resort institutions, preventoria, rest homes, boarding establishments, tourist centers and other institutions for the treatment and strengthening of the health of citizens."

3. Clause four of Article 6 to be set forth in the following wording:

"(4) establishment of all-union plans of production and distribution of products of the medical industry among union republics, ministries, state committees and departments of the USSR, exports and imports of medicinals, objects of medical equipment and other products of medical designation."

4. The fifth part of Article 8 to be set forth in the following wording:

"Local soviets of people's deputies and their executive committees supervise health-care organs and institutions subordinated to them, implement measures for the development of the network of health-care institutions and their proper distribution and strengthening of the material-technical base and organization of medical assistance to the population, coordinate and control the operation of all enterprises, institutions and organizations on the development and implementation of measures in the field of health protection, ensuring of the sanitary-epidemic well-being of the population, organization of rest of workers, development of physical culture, protection and improvement of the environment and also exercise control over observance of legislation on protection of the health of the population."

5. The second part of Article 9 to be set forth in the following wording:

"Other ministries, state committees, departments and organizations may have under their jurisdiction health-care institutions only with the permission of the USSR Council of Ministers and are obligated to administer them in accordance with legislation of the USSR and union republics on health care."

6. There should be added to Article 12 following the third part a new part with the following content:

"A physician, who has not worked in his profession for more than three years, must go for training to an institute for advance training or to other corresponding health-care institutions with subsequent admission to medical activity in a manner determined by the USSR Council of Ministers."

The fourth part of Article 12 to be considered the fifth and the fifth part as the sixth.

7. The first part of Article 16 to be set forth in the following wording:

"Physicians and other medical and also pharmaceutical personnel do not have the right to divulge information on diseases and intimate or family life of citizens that has become known to them by virtue of performance of professional duties."

8. The second part of Article 18 to be set forth in the following wording:

"Carrying out of sanitary-hygienic and sanitary-antiepidemic measures aimed at making the environment healthier and at improvement of conditions of work, mode of life and rest of the population, prevention and reduction of morbidity is a duty of all state organs, enterprises, institutions and organizations, kolkhozes, trade unions and other public organizations."

9. The first part of Article 38 to be set forth in the following wording:

"Motherhood in the USSR is protected and encouraged by the state; conditions are created for women, making it possible to combine labor with motherhood; legal protection, material and moral support of motherhood and childhood are provided."

10. The second part of Article 51 to be set forth in the following wording:

"The manner of organization and production of forensic-medical and forensic-psychiatric examination are established by the USSR Ministry of Health in coordination with the USSR Supreme Soviet."

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